proActive
The official industry newsletter of Lotus Engineering

Issue 25
Mar/Apr 2008

Cars running on CO_2
a vision for future transport

White riot
Project Eagle development in Northern Sweden

Interview with Victor Nacif
Nissan Design America

Welcome

The early spring is invariably hectic at Lotus and this year has been no exception. The Geneva motor show is a focus for not only Lotus Cars but also the Engineering business, which this year unveiled two exciting technologies.

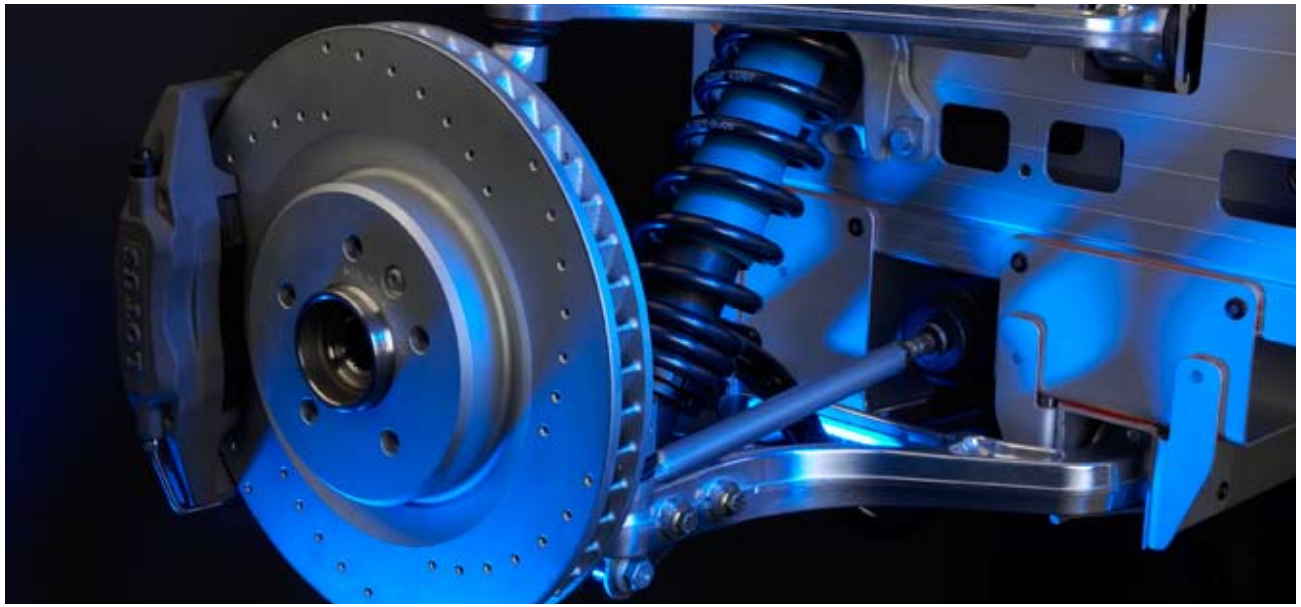
The world had its first glimpse of the technology behind Project Eagle, our all-new sports car, which will be unveiled later this year. The aluminium front structure and chassis systems on show demonstrated the evolution of the Lotus versatile vehicle architecture which will underpin a fantastic Lotus sports car.

The second engineering debut was the Exige 270E Tri-fuel technology demonstrator. Running on any mix of three fuels – bioethanol, methanol and gasoline – the car itself is a fantastic showcase of our sophisticated calibration strategies and combustion understanding that are part of our extensive alternative fuels research.

But arguably an even more important role of the 270E Tri-fuel is to highlight the long-term opportunity for synthetic fuels like methanol in renewable, sustainable transport. The technology is emerging to develop these fuels on an industrial scale from carbon extracted from CO_2 in the atmosphere. And that can mean carbon neutral transport from a practical liquid fuel that won't affect the consumer at the pumps.

That's an exciting vision, and one that we advocate the industry, governments and consumers explore. Hopefully we can create that debate.

Peter Morgan
Marketing Manager – Lotus Engineering



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> Second-generation biofuels also have the advantage that they do not displace food production.

Maruti Suzuki India A-Star concept

INDIA: Suzuki plans world car, new engines

Suzuki is planning to produce its next world car based on the A-Star concept at Gurgaon, near Delhi, by the end of 2008, according to remarks made by Shinzo Nakanishi, managing director of Maruti Suzuki India (MSI).

Suzuki is also planning to export some 100,000 units annually, including substantial shipments to Europe.

According to the *Economic Times* newspaper, MSI is replacing the engines of its existing small cars with a new series of next-generation engines.

The upcoming A-Star world car model will have a new 1- litre 'K-series' Euro V engine and the other existing small cars – Zen Estilo, Swift and WagonR – will use the different sizes of the same series (up to 1.3-litre) in the next few years, the paper said. Their current F and G series Euro III engines will be phased out subsequent-ly by 2010.

Nakanishi told the *Economic Times*: "Our new cars will have next-generation engines. Manufacturing will commence later this year in Manesar. The engines have been developed keeping in mind the developed markets of Europe and the US. So, we will target the export market in a big way while the same engines would be used for domestic cars as well."

According to sources in the automobile industry, Maruti will launch the next generation engine project with the debut of A-Star in October, which will be followed by the other soon-to-be-launched hatchback , Splash. The K-series engine will be pitted against Hyundai i10 's 1.1-litre, iRDE engine and the Chevrolet Spark's 1-litre 4-cylinder SOHC engine.

"The [new] engines are expected to deliver highest fuel efficiency and excellent environment protection. The state of the art engine in A-Star will have the lowest carbon emissions in India. These engines will meet all emission norms for the next decade," Nakanishi told the newspaper.

Source: just-auto.com editorial team


Sugar cane can be used for biofuel

GERMANY: VDA points to second-generation biofuels as way forward

In response to the German government's decision to abandon its policy of blending 10% ethanol with petrol, Matthias Wissmann, president of the German vehicle manufacturers trade association, Verband der Automobilindustrie (VDA), said that biofuel blending is just one part of the Germany automotive industry's strategy for biofuels and investment in second generation biofuels is much more important.

By making use of waste agricultural products that can deliver a 90% reduction in CO_2, compared to 50% for biodiesel, for example. Wissmann said industry should not dismiss this potential source of climate protection.

Second-generation biofuels also have the advantage that they do not displace food production.

Wissmann added that second-generation biofuels can also be better quality than current biofuels.

Wissmann said: "We must not give up on this goal. It is clear that biofuels should only be used where they meet sustainability standards."

Of VDA members, Volkswagen, Daimler and GM are currently developing second generation biofuels.

Source: just-auto.com editorial team

Industry **News**

> An energy consultant told suppliers that saving energy can start with something as simple as turning off the lights on soft drink and snack machines.

CHINA: SVW eyes Fiat/Nanjing plant

Shanghai-Volkswagen (SVW) is considering taking over Fiat's manufacturing facility in China as it seeks to boost capacity in China.

"There are several options. Nanjing [Nanjing Auto, now merged with SAIC] would be one of the options," Kai Grueber told *AFP*, referring to the east China plant which Fiat has agreed to sell to SAIC.

But the venture has not signed any agreement to take over the Fiat plant, he added, denying a report in the official *Shanghai Securities News* that a deal had been reached.

The report said the plant had annual production capacity of 60,000 vehicles a year, which would increase to 100,000 by 2010.

"We are still in a phase of growing and need to increase capacity. It will be done step by step in line with demand," Grueber said.

"We want to surpass the 1m mark this year."

Source: just-auto.com editorial team

GERMANY: Daimler sees fuel cells in 5-8 years

Daimler chief executive, Dieter Zetsche, has said that he is confident that fuel cell vehicles will be on sale within the next five to eight years, and that they will compare favourably with current technology.

He told *Wirtschaftswoche* the question now is whether a hydrogen infrastructure can be put in place to support vehicle developments and whether the energy balance of the hydrogen delivers any real carbon benefit.

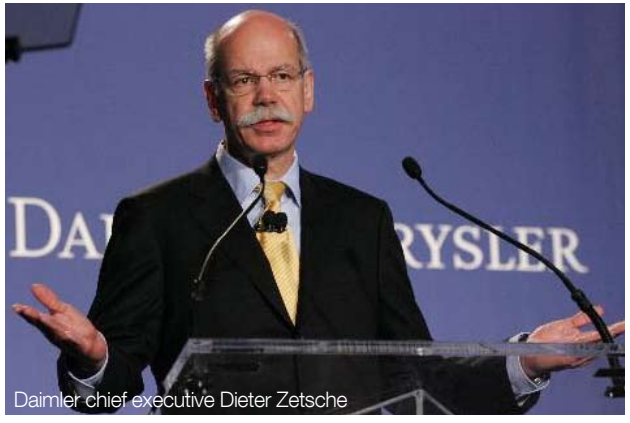
Zetsche said the advantage of fuel cells over electric cars is that they have a range of around 300 miles (500km) on one tank of fuel. The range of electric batteries is limited to around 95 miles (150km) and requires a charge of five to six hours.

Zetsche also reaffirmed the European automotive industry trade association (ACEA) view that EU proposals to limit average CO_2 emissions to 120g/km by 2012 are not achievable as 60% of the cars that will be on the market in 2012 are already on sale today.

Zetsche also said a decision on a new plant in Eastern Europe would be made in the second quarter of the year and possible locations include Poland, the Czech Republic and Romania.

He added he could envisage a future acquisition in the truck market. Daimler is looking for opportunities in Russia, in particular.

Source: just-auto.com editorial team



Daimler chief executive Dieter Zetsche

A Quest minivan begins its trim line journey at Nissan's plant in Canton, Mississippi

US: Nissan shares energy tips with suppliers

Nissan's US unit recently held a conference to share energy-saving ideas with suppliers.

An energy consultant told suppliers that saving energy can start with something as simple as turning off the lights on soft drink and snack machines.

Fred Schoeneborn, an Environmental Protection Agency energy consultant, told the *Associated Press*, after touring Nissan's assembly plant in Smyrna, Tennessee, that everyone in the workplace has to be involved.

He noted Nissan had lights in vending machines unlit, in addition to numerous other reductions in lighting and use of equipment.

The plant builds the Altima coupe and sedan, Frontier pick-up, Xterra sport utility vehicle, Pathfinder SUV, and Maxima sedan and Nissan has another assembly facility in Canton, Mississippi.

Source: just-auto.com editorial team

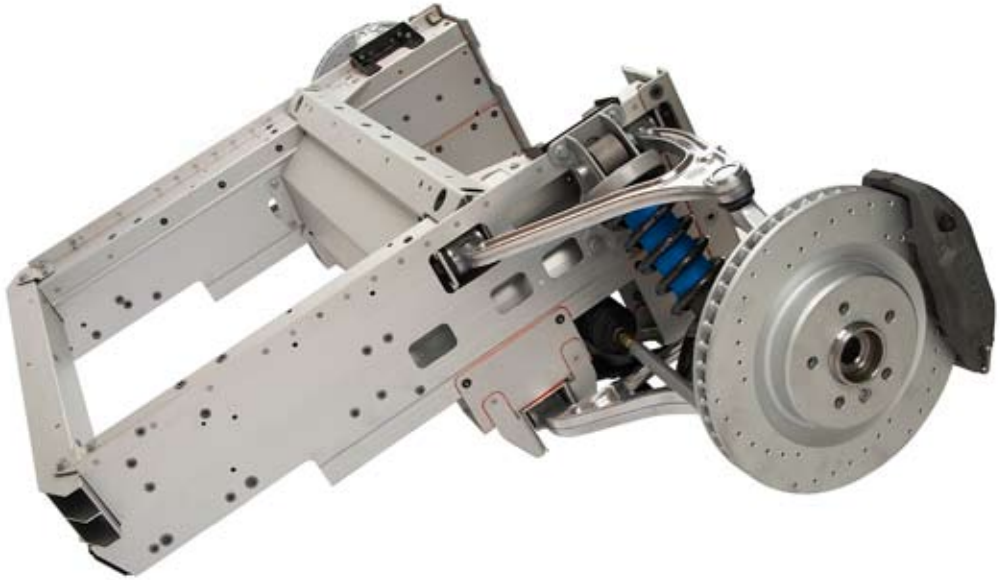
> Project Eagle employs a composite roof as a stressed structural member to give an exceptional vehicle stiffness of 26,000Nm per degree.

First Glimpse of Project Eagle

The innovative Lotus Engineering Versatile Vehicle Architecture (VVA) technology offers a fast-to-market, cost-effective approach to differentiated niche products by spreading the development, investment and the bill of materials burden across a range of vehicle variants, without the compromise that stems from conventional 'platform sharing'. The philosophy is based on the commonality and versatility of key elements of the vehicle structure and body systems across a 'family' of niche vehicle variants that meet all world homologation and safety requirements.

Richard Rackham, vehicle architect of Lotus Engineering said: "Producing a bespoke low volume platform using normal methods is uneconomical, whilst sharing a mainstream platform normally results in compromises in performance and design. Traditionally, car manufacturers seeking to gain competitive advantage through exciting niche vehicles have to either design a new platform or share one already available.

"The great advantage of this VVA technology is that it can be used by one car manufacturer looking to develop a range of niche products, or by a group of car manufacturers looking to share investment, but still retain a high degree of end product separation." The Project Eagle chassis is an evolution of the VVA from the Lotus APX concept vehicle previously showcased at Geneva, and allows for the development of a range of vehicles up to a gross vehicle weight of 1,900kg. This architecture has been designed to be more applicable to mid-volume applications by utilising low capital investment manufacturing processes. The Project Eagle structure progresses the Lotus bonded technology used in the Elise family of vehicles with



unique extrusions and folded panels, whilst providing contemporary ease of ingress/egress, build modularity and improved, lower-cost repairability.

The Low Volume VVA architecture has been designed so that it can be stretched in width, length and height. The strength and stiffness of the low-volume VVA chassis can be modified cost-effectively by varying the wall thickness of the extrusions, without altering the exterior dimensions. Combining the ability to lengthen or shorten extrusions with the option to tailor the chassis stiffness vastly increases the number of vehicles that could be developed from this vehicle architecture. Front and mid-engine installations have been considered, as well as hybrid and electric vehicle applications.

Project Eagle employs a composite roof as a stressed structural member to give an exceptional vehicle stiffness of 26,000Nm per degree. To deliver this high performance structure, bonded and riveted high grade aluminium extrusions and simple and elegant folded sheet elements are used in the lower-structure, building upon award winning research projects in this field. Lotus pioneered the aerospace technology of bonded aluminium extrusions for use in road vehicles and has successfully developed high-performance cars for global engineering clients using this approach.

The innovative VVA architecture for Project Eagle consists of three distinct parts, with the centre occupant section being the largest. Bolted to this centre section are the rear sub-frame to which the engine and rear

> One of Lotus Engineering's strengths is its ability to streamline design and development, thereby reducing time to production and project costs.

suspension are attached and the front module that incorporates the bumper beam and side members that progressively absorb crash energy. Practicality has been a major consideration with in-built serviceability factored into the design. Various systems attach to the front module including the suspension, cooling pack, HVAC and body. The aluminium front module on its own measures 938mm long, 864mm wide and 387mm tall and weighs in at a featherweight 25kg, again 'ecologically' biased.

Project Eagle suspension wishbones are forged from aluminium to reduce the unsprung mass. These are similar in weight to the steel items found on the much smaller Elise, Exige and Europa vehicle, but have a far higher vehicle weight capability. They attach to the front module via bespoke lightweight bushes. All Lotus cars have to be fun to drive and deliver a sensational, class leading driving experience. Project Eagle will be using Bilstein dampers and Eibach springs with unique dual-path top mounts for optimised vehicle refinement. The high performance bespoke Lotus AP Racing 4 pot callipers work in tandem with ventilated crossdrilled 350mm diameter brake discs to ensure phenomenal stopping power. Hydraulically-assisted power steering will be employed with a TRW steering rack.

The development of Project Eagle is advancing rapidly, with engineering prototypes already conducting testing in Northern Europe and at Lotus' headquarters at Hethel, England. The ride and handling and cold weather testing currently being undertaken forms an early part of the demanding worldwide industry standard vehicle development programme for Project Eagle.

One of Lotus Engineering's strengths is its ability to streamline design and development, thereby reducing time to production and project costs.

Source: Lotus Engineering

“The result was a generous 70-plus hours of engineering time dedicated to repairing the sled and preparing it for the extreme conditions of competitive Bobsleigh.”

The Royal Air Force Bobsleigh Team joins forces with Lotus

In a major first for the Royal Air Force (RAF) Bobsleigh Team, they have joined forces with Lotus Cars which have been commissioned to repair and refurbish one of the sleds from the RAF Bobsleigh Team. With the Inter-Services Ice Championships for 2008 being held at the 1200 metre Innsbruck/Igls Olympic Bobsleigh track in Austria, the team is taking the opportunity to test Lotus’ engineering skills by running this newly-refurbished sled on the track.

“Initially we had a requirement to repair a sled which had sustained significant nose cone damage, a huge body crack in the main chassis itself and multiple other cracks and damage that had been sustained over the years” said Bobsleigh team manger Flight Lieutenant Craig Dickie. “As an engineer myself and with an understanding of Lotus’ expertise in dealing with composite materials, I approached their engineering department initially to discuss the possibility of them assessing a sled with a view to me paying for any work that needed carrying out. Lotus recognised the value of an affiliation between themselves as an elite car manufacturer and an extreme sport like Bobsleigh and this developed into the repair of the project prototype; which so happened to be the worst sled in our inventory.”

The result was a generous 70-plus hours of engineering time dedicated to repairing the sled and preparing it for the extreme conditions of competitive Bobsleigh. For Lotus it was an ideal opportunity for them to demonstrate their state-of-the-art engineering skills; Mike Kimberley, Chief Executive Officer for Group Lotus plc is very enthusiastic about the association, “When the RAF Bobsleigh Team approached us, we were immediately grabbed by the very clear association between our high performing, exciting and high technology sports cars, advanced RAF aerospace engineering and the exciting and extreme sport of Bobsleigh. We are regarded as a world leader in composite research, development and manufacture and we are delighted to be given the opportunity to demonstrate our skills outside the car industry. The advanced composites repairs have been done to an extremely high quality, keeping weight to a minimum and are another example of our skills and the resulting sled has been returned to the RAF as good as new.”

Shooting by at 85 mph with Olympic Bobsleigh driver RAF Sergeant Michelle Coy at the controls and Junior Technician Caroline Gray as brakeman, it was hard to imagine that just a few months ago the sled’s condition had been assessed as a safety hazard, with little hope of it being restored to use without significant funds being diverted from more pressing priorities. With the cost of buying a new sled ranging from GBP11,000 for a training sled to GBP25,000 for a top-of-the-range carbon fibre racing version, the benefits of working with Lotus are obvious.

Source: Lotus Engineering

> These new Europa variants have been designed and developed especially for European customers and will be sold exclusively across Europe from June 2008.

Lotus 'Entry-level' 2-Eleven

Choosing your track day performance car has just become a lot more exciting with the introduction of the entry-level 2-Eleven and extensive range of Lotus Sport performance options.

The latest Lotus 2-Eleven, bristling with Lotus Sport options and wearing a dramatic carbon fibre body was exhibited at the 78th annual Geneva International Motor Show. This car has been specified with, amongst other options, the 255PS (252bhp, 188kw) power upgrade, carbon fibre tonneau cover, four piston front brakes, 'Aero Pack' and 'Sport Pack' as an example of how the new range of Lotus Sport options can be configured.

Mike Kimberley, Chief Executive Officer of Group Lotus plc, commented: "The 2-Eleven has been exceptionally well received worldwide, which has provided Lotus with a significant challenge to keep pace with demand." He went on to add: "It is very encouraging to see that the 2-Eleven is asserting itself as class leader in the track day enthusiast sector and to hear all the incredibly positive feedback from people enjoying the 2-Eleven's fantastic performance".

The 2-Eleven made its global debut at the 77th annual Geneva International Motor Show in 2007. Available in launch specification with the supercharged 255PS (252bhp, 188kW) engine, in either UK Single Vehicle Approval (SVA) or Track Only guise. After suggestions from Lotus racers and owners, the 2-Eleven will now be available as an entry-level car with a number of option packs to tailor to owners' individual requirements. As well as a number of performance option packs such as the Track Day pack and UK road SVA pack, there are a range of stand alone options that now include two different Limited Slip Differentials, an FIA approved 70 litre bag fuel tank and a removable competition steering wheel.

The entry-level car, which at 720kg (1,600lbs), epitomises the Lotus "performance through light weight" mantra, is powered by the naturally aspirated, high-revving 190 PS (189hp, 141kW) engine from the Elise R. This 2-Eleven even in its most basic specification shows a remarkable turn of pace with the sprint to 60mph taking just 4.3s and achieving a top speed of 140mph (225km/h).

Source: Group Lotus plc

2008 Lotus Europa Range

Group Lotus plc unveiled a new updated and significantly enhanced range of Europas at the 78th annual Geneva International Motor Show. The new entry-level Europa is priced at GBP27,950 MSRP/EUR37,500, with the range-topping Europa SE available for a competitive GBP32,995 MSRP/EUR41,500 (Euro prices are without taxes, delivery and other related costs).

These new Europa variants have been designed and developed especially for European customers and will be sold exclusively across Europe from June 2008. The Europa is now available to a larger target audience with the entry-level car providing a more accessible way to own a Europa and the SE designed to appeal to those who are even more style-conscious and want increased levels of performance.

Mike Kimberley, Chief Executive Officer of Group Lotus plc, commented: "As the true driver will know, this Europa range offers access to Lotus' unique DNA for those who perceive the Elise and Exige as a little too uncompromising for everyday use. The new Europa SE sits at the more refined end of the Lotus spectrum, providing a terrific mix of performance, agility and style, but incorporates Lotus's values and heritage".

The Europa has a mid-mounted 2 litre turbo charged engine, tuned in the SE with an all new calibration to 225PS and with 300Nm of torque to offer effortless cruising capability. Even though the Europa is engineered with more relaxed driving characteristics it provides amazing performance, with 0-60mph in the SE dispatched in 5.5s (0-100km/h in 5.7s) and the sprint to 100mph (160km/h) taking just 13.0s. Given the legal opportunity to stretch its legs, the Europa SE will hit a top speed of 143mph.

The Europa SE has attractive and lightweight new wheels, which are shod with wider, high-performance tyres, for increased levels of grip. These new high-performance wheels are larger with 17-inch rims up front, and larger 18-inch rims on the rear. The new wheels house high-performance AP Racing four pot brakes and larger (308mm) diameter discs.

The SE interior has been updated by Lotus Design with a stylish new design that works in harmony with the premium *avant-garde* Ice White of the Geneva Show car. The interior is finished using four hides of soft, lightweight high-grade leather, to ensure that every surface has a luxuriant tactile feel.

Source: Group Lotus plc

> Chapman's theory of 'performance through lightweight' formed the foundation of one of the most successful racing teams to date and is imbedded in the Lotus philosophy.

Lotus celebrates diamond anniversary

In this its 60th year, Group Lotus plc is taking the 'diamond' element of its anniversary to heart and is celebrating in style. A variety of high-profile events have been planned for 2008 that will pay homage to the heritage of the marque and look forward to the future of the international brand.

The pinnacle of the campaign is a landmark event held at the Lotus Headquarters in Hethel, England on 14 September 2008 and will be opened by Hazel and Clive Chapman.

Lotus has a history of holding fantastic public events and the 60th Birthday Party will follow this vein. Over 15,000 visitors are expected and will be a fun-filled day that all the family can enjoy.

It was in 1948 that Colin Chapman built his first racecar. A pioneer, his breakthrough engineering firmly established him as one of the greatest automotive engineers of the 20th century. Chapman's theory of 'performance through lightweight' formed the foundation of one of the most successful racing teams to date and is imbedded in the Lotus philosophy.

Group Lotus plc Chief Executive Officer Mike Kimberley speaks passionately about celebrating Lotus milestone: "This is a great opportunity to celebrate the past and look forward to both a very special year for Lotus and a fantastic future. It's important to us to celebrate the spirit of Lotus and we invite everyone to our headquarters to meet our people, our staff and our fans, and see us moving forwards.

"In 2008 an all new car will be unveiled at the London Motor Show and an impressive global expansion programme is planned for our high-tech Lotus Engineering Consultancy, so there's an exciting energy at Lotus that we want to share with our wider communities." An invitation is extended to all to join Lotus on 14 September 2008 for a day's celebrations and with it the chance to experience the majesty of the marque and be part of Lotus' tomorrow.

Source: Lotus Engineering

Lotus announces introduction of Hybrid & Electric Vehicle Group

Lotus Engineering has created a new research and development group solely for electric and hybrid vehicles. The formation of this group recognises the increasing global importance of hybrid and electric vehicles, and the increasing amount of consultancy project work in this area that is being undertaken by Lotus Engineering.

Mike Kimberley, Chief Executive Officer for Group Lotus plc, said, "I am pleased to confirm the formalisation of this existing team, which will support our strong global growth on ecological technologies. We have an intensely proactive growth plan over the next five years and we are already seeing substantial increases in third-party client work for our global client base, of which considerable research and development into hybrid and electric vehicles is a major part. Indeed over the next five years, Lotus will further reinforce its position as a world leader in green transport engineering."

Phil Barker has been appointed as chief engineer of Hybrid and Electric Vehicle Technologies and will report to Geraint Castleton-White, head of Powertrain. Geraint is delighted with the group's formation: "We are committed to driving forward with green technology for both Lotus Cars and our Engineering clients. We have made significant developments over 20 years in hybrid and electric vehicle technologies with recent examples being the Lotus EVE (Efficient, Viable, Environmental) hybrid technology demonstrator and the Low CO_2 project undertaken in collaboration with Continental Division Powertrain."

Phil will have full responsibility for research and development of hybrid and electric vehicles within Lotus Engineering and is relishing the challenge. Barker said: "This is a fantastic opportunity for me to continue the already ground-breaking and successful work conducted on hybrid and electric vehicles by Lotus Engineering. We already have an incredibly strong team of engineers working in this area and the formalisation of this group further enhances our ability to provide both Low CO_2 and zero emissions vehicle solutions to our clients."

Barker, 41, began his career at Lotus in 2003 as an Executive Engineer focusing on hybrid and electric vehicles. Prior to joining Lotus, he spent over 13 years working for independent automotive design consultancies. Barker is a graduate in Mechanical Engineering from Coventry University and is a Chartered Engineer. He is married and has two young children.

Source: Lotus Engineering

Phil Barker, chief engineer of Hybrid and Electric Vehicle Technologies

White riot

Project Eagle development in Northern Sweden

> “I glance across at the speedo. We are doing 100kph, sideways, on a frozen lake.”

The Eagle mule car put us in a spin at Bosch’s test facility in Northern Sweden. If it is anything to go by, writes Johnny Tipler, the fully-fledged Lotus will be one heck of a car. Even on ice...

I glance across at the speedo. We are doing 100kph, sideways, on a frozen lake. I am the passenger in the Lotus Eagle mule car. It’s a left-hooker so I’m assuming we’re in kilometres rather than miles-per-hour, but it’s hard to be sure in this unfamiliar all-white context. Like the snow in these parts, the thrills come thick and fast.

Most manufacturers seek a modicum of privacy when developing a new model, and the more remote and inhospitable the better. These wilds go on for ever. A raw location also has the advantage of providing an extreme environment in which to hone handling and drivetrain. An unpronounceable name is even better: adds mystique and inhibits snoopers. We’ve come to Arjeplog in Northern Sweden, a stone’s throw from the Arctic Circle, where the Eagle mule car is being fine-tuned at Bosch Engineering’s Vaitoudden chassis control winter test facility.

While conditions are relatively consistent at Arjeplog, in so far as it’s sharp at minus 7C on our visit and snow is a given in winter, there’s sufficient variety on these remote roads where slush, ice and bare asphalt present different friction levels. Other, less predictable, natural hazards lurk in the forests too. As Bosch’s test driver and project leader Alex Böß puts it, “the car has to be stable when you’re braking, particularly when an elk steps out in front of you.”

Hold on a minute, though: doesn’t Bosch make dishwashers and power tools? Yes indeed, headlamps and wiper blades too. But its Engineering services subsidiary has long been involved in automotive engine management hard- and software, ABS and traction control systems. It’s 30 years since it launched the first ABS (anti-lock braking system) in the Mercedes-Benz S class. That’s how long the German manufacturer has operated beside the frozen lake. A decade later, its traction control system was up and running, and in 1995 it launched its Electronic Stability Programme (ESP). Around 250 technicians work in the laboratories and offices at Arjeplog, and though the majority are from Germany, there are a few representatives from the global automotive industry knocking around, including Lotus. It depends whose cars they’re working on, and there’s a pretty good cross-section here now. Bosch staff’s Arctic role is transitory, averaging 12 weeks over six fortnightly stints, swapped for the less austere climes of their Stuttgart HQ.

This Bosch and Lotus joint venture began in summer ‘07, when the Eagle project took off. Bosch was charged with developing and implementing the ESP system on the car, bearing in mind US legislation, which included a basic ABS and TCS (traction control system). The Eagle is a totally different car to the Elise and Exige so they started with a clean sheet. Though engineering principals are similar, there are no shared components, so everything is brand new as far as the Eagle is concerned. The way it works is Bosch Engineering develops new functions for one manufacturer and installs the same hardware in different client’s cars, then fine-tunes it according to specific requirements and applications. That makes it vastly cheaper for the recipient, as there is no need to develop new hardware, electronics and hydraulics, simply to adapt and develop the requisite software for the fresh installation. It’s not that Lotus lacks the expertise to create and implement such componentry itself, far from it: the company pioneered computerised suspension in the 1980s and the Lotus Traction Control System (LTC) entered production in 2005; the chief obstacle is that it’s just too expensive to manufacture the hardware from scratch for the new model, hence the involvement of Bosch. “Working in harmony with the Lotus vehicle dynamics engineers we adjust and apply an existing system to a new car,” says Böß. “On the one hand it’s lower cost, and on the other you have proven systems to work with on a totally new car.”

The mule is supplied by Lotus – a well-used Esprit shell tantalisingly clads the Eagle’s chassis and drivetrain, though the engine note is distinctive – and after last year’s technical discussions and negotiations on electronics, the two companies agree on the most appropriate systems on which to base the Eagle installations. “Originally we had a lot of issues to discuss for the electrics,” explains Böß, “because Lotus never had a big CAN (control area networks) protocol for the different parts working together, so we had to find out which signal worked best for what application, in order to establish a network for the ECUs in the car so that they could ‘talk’ to the engine and the dashboard. The Lotus engineers fully understand the requirements for their engine ECU and quickly installed the electronic soft and hardware in readiness for our development work to begin.”

Bosch’s first act was to implement all the measuring equipment and establish the engine ESP communication, and the mule was taken to Spain to undergo the ‘high friction’ phase on a test track near Barcelona. “We normally test cars there during the autumn and winter season because it is quite dry. It’s regularly used for car testing, tyres, engines and stability control systems. So the Eagle project started not here in Sweden but in Spain.”

White riot
Project Eagle development in Northern Sweden

> “Cars have to be parked at least 5 metres apart so that the weight won’t be too concentrated.”

Ironically, fickle weather meant a late start at Arjeplog as the lake was only accessible from late December. “The temperature was cold enough, but there was too much snow,” recalls Böß. “When the snow covers the ice it will insulate it so the crust won’t get thicker, and it’s a Catch-22 because you can’t go on the ice and clean the snow off as it’s too thin. So actually you need cold temperatures without snow at the beginning, and then later on, snow is nice.” By December it had frozen to a depth of 50cm, thick enough to support even the trucks and buses that Bosch is producing ABS systems for. ”We test on the same tracks as the commercials, and when you stand next to the car you can feel when a truck is coming because the ice goes up and down. It’s like the earth’s mantle which is made up of plates and the currents underneath the plates move them on the lake surface, making little bumps.”

Time for an outing. The prototype’s cockpit is akin to a racing car and nothing like the Esprit that it purports to be. Negotiating the roll cage and bucket seat is the work of a gymnast, and I endeavour not to nudge the open laptop mounted ahead of me that logs the telemetry. The gear selection linkage is exposed and mounted higher than it would be in an Esprit, while most of the instrumentation is a typical prototype lash up, with lots of cables bundled underneath. As soon as the car’s in motion the laptop screen comes alive, displaying a multitude of different coloured lines that register the slightest twitch. ”Traction control is always working out here,” Böß tells me, which is reassuring, though not entirely convincing as I’m currently looking out of my side window in the direction we’re travelling. “The car will change behaviour without switching to sport mode. All the time we’re testing it we are logging data, seeing what the effect is and making minor adjustments. We take a measurement, and we’ll have a subjective feeling about it and if it’s not good, we’ll stop and assess the measurement, interpret the details and change the parameters in the computer and download them on the ECU.”

There’s a marquee out here, like something out of a village fete; the only difference is it’s in the middle of a frozen lake rather than a meadow. “This is the presentation area,” says Böß. ”It’s where we present the cars to the manufacturers when it’s handover time.” Böß drives confidently on the white stuff – as you’d expect. There are no regulations on the number of cars that can be on the lake at any one time, but it does depend on the thickness of the ice. Cars have to be parked at least 5 metres apart so that the weight won’t be too concentrated. ”Maximum speed is meant to be 70kph, but that is slow,” says Böß. ”We need it to be more as nobody is driving at 70. Normally you can drive here at 90.” Yeah, and the rest!

They’ve got two handling courses out on the ice, nearly 2km each, plus a ‘dynamic area’ which includes firmly packed snow, rough ice and black ice, and the vista is flat as far as the eye can see. The circuits are delineated by snow banks, which we don’t want to hit as it’s a bore having to wait for the site Land Rover to come and haul us off. He deftly slides the Eagle mule onto the snow circle, a 300-metre oval with a glistening inner ring, polished by tyres, abutting the outer compacted snow circuit. In no time at all we’ve done two 360-degree spins, but mostly we are broadside one way or another as he goes from lock to lock. The front wheels catch the ice rink and we pirouette. Again, and again. Maybe he’s become snow-blind, I wonder. But no, he clearly loves his job and who wouldn’t.

“We don’t have interventions on board at the moment; the only thing we have is ABS and the traction control system. In the next stage of the project we will have the interventions ready for the brakes. When the car slides like that we’ll be able to just brake the right front wheel to reduce the grip. At the moment the only thing we can do is reduce the slip of the rear wheels by keeping the traction, and this is always the difficulty, we don’t want to lose engine power, but we do want to have a stable car.” When testing the car for real, as opposed to looking dramatic for the camera, the telemetry will tell him what’s

White riot
Project Eagle development in Northern Sweden

> “Then, with a bit of yaw and a definite roar, we rocket up the hill. It’s a simple but effective demonstration of the car’s prowess.”

going on and he will respond accordingly: “I will have to say, ‘OK, I don’t like that situation, I need to check what’s happening.’”

According to Böß, the Lotus is a relatively easy car to drive. What constitutes a difficult one, then? “A very heavy one, like the Porsche Panamera or the Bentley Continental which are very powerful but when you drive them on the ice, for example, and something goes wrong, it’s too late, you have no chance to get the car back on track.” I notice that certain sections of the Esprit body are slightly the worse for wear, though it is merely the mule. “The Lotus has only crashed once this season but nothing’s broken because the snow is normally soft, so if you’re lucky it’s just bouncing off the snow bank and you’re back on the track. Yesterday there were very bad conditions and the tracks were closed because of a heavy storm so you couldn’t see anything on the lake, and also you had snow banked across the track because of the wind.”

Back on dry land (the knolls and trees give it away), Böß brings the Eagle to the site’s test hills, three differing gradients (10%, 15% and 20%) covered over by open-ended barns. Up the left-hand side of each run is a 25 metre strip of solid ice. He positions the Eagle at the start of the hill. Without sport mode deployed it slides inexorably backwards when he attempts to pull away. There’s no grip whatsoever. He presses the button, and now the traction control system comes into play to stop the inside rear wheel spinning and takes the power to the outside wheel, which is on asphalt to the right-hand side, where it senses it will get some purchase. Then, with a bit of yaw and a definite roar, we rocket up the hill. It’s a simple but effective demonstration of the car’s prowess.

Böß quotes another example: “Quite often up here, on normal straight roads, on one side you have asphalt and on the other you have ice or snow where you have no traction, and you also have this kind of control. In a sharp corner, normally the inside wheel will spin so you lose traction, and it’s the same there: you are going to brake the inside wheel and transfer the torque to the outside wheel.”

All the work is carried out in the garages and offices, where there’s support from the measurement teams when they hit problems with equipment or the car is broken. “We’ll do the fine-tuning on the curves and on the open roads facility. We have to drive there because we want constant conditions, so if we have a problem with the software on Monday, we want to re-test or verify it on Wednesday in exactly the same conditions. So to make the fine-tuning and the last calibrations on the system we need longer roads to get a good feeling for the car. You need time for that.”

And there is a limit, because by April the ice will have melted. Normally Easter is the cut-off point when work stops at Arjeplog. By then, all being well, the Eagle will have landed at Hethel to start the next stage of the programme.

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Cars running on CO_2
A vision for future transport

> The result is that a car running on synthetic methanol, such as the Exige 270E Tri-fuel would be environmentally CO_2 neutral.

At the recent Geneva International Motor Show, Lotus Engineering unveiled its latest development towards carbon neutral road transport. The Lotus Exige 270E Tri-fuel is the most powerful road version yet of the Exige and it runs on any mixture of gasoline, bioethanol and methanol. It is part of Lotus' research to understand the complex combustion process involved in running on mixtures of alcohol fuels and gasoline, which will be important for a successful transition from today's fuels to the sustainable, synthetic fuels of the future.

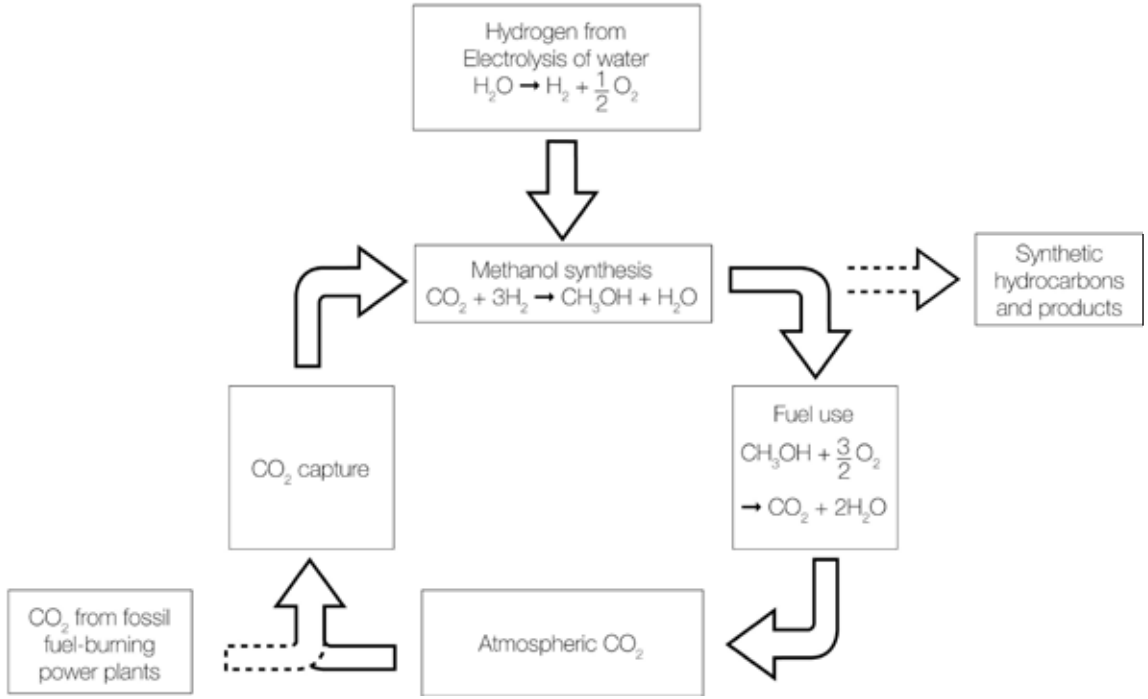
Lotus Engineering's previous high profile work in biofuels with the Exige 265E Biofuel demonstrator showed the performance and environmental benefits of bioethanol. This activity was focused on the nearer term benefits and application of alternative fuels technology. However, Lotus sees biofuels as a vital stepping stone to an exciting future where alcohol fuels are renewable, sustainable and carbon neutral. The 270E is important not only as a testbed for the advanced combustion and calibration techniques for these fuels but also, and perhaps more so, to help raise awareness and stimulate debate on the potential of synthetic alcohols for a sustainable green future for transport.

So what is meant by a synthetic alcohol? Emerging technologies will allow alcohol fuels such as methanol, already a proven internal combustion fuel, to be made synthetically from CO_2 extracted from the atmosphere. Such an alcohol-based fuel derived renewably from atmospheric CO_2 would allow society to transfer relatively easily to sustainable, carbon-neutral internal combustion. Methanol (CH_3OH) can be produced synthetically from CO_2 and hydrogen. Ultimately, emerging processes to recover atmospheric CO_2 will provide the required carbon that can entirely balance the CO_2 emissions at the tailpipe that result from the internal combustion of synthetic methanol. The result is that a car running on synthetic methanol, such as the Exige 270E Tri-fuel would be environmentally CO_2 neutral.

The most likely future mass-production of the fuel is by using electrochemical techniques to combine oxygen, hydrogen and carbon:

• Carbon could be sourced from carbon dioxide recovered from the atmosphere using either large scale extraction facilities or biomass.

Proposed Synthetic Methanol Cycle



• Oxygen would be taken from the atmosphere already contained in the CO_2 molecule.

• Hydrogen would be acquired through the electrolysis of water; challenges remain in the electrical power required; in a green future, this could be supplied from renewable sources, an issue already being addressed by supporters of hydrogen as a fuel.

• Synthetic methanol can also be supplemented by production from biomass sources where properly sustainable.

• Methanol can be produced easily from a wide variety of feedstocks.

Techniques for the production of synthetic methanol through the extraction of atmospheric CO_2 are well developed and understood but are not being employed on an industrial scale. An early solution would be the co-location of a nuclear or hydroelectric powerplant with a conventional power station – the hydrogen generated by hydrolysis of water would be combined with CO_2 from either fossil or biomass sources to make liquid methanol. In the future, large volumes of CO_2 could be extracted directly from the atmosphere.

As well as being green, the great benefit of synthetic methanol is that it would use similar engines and fuel systems to those in current cars; and synthetic methanol can be stored, transported and retailed in much the same way as today's liquid fuels such as gasoline and diesel. It can also use the current fuel distribution infrastructure, which is a huge advantage for suppliers. These are huge challenges being faced by hydrogen as a future transport fuel. A sustainable

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> “The Lotus Exige 270E Tri-fuel technology demonstrator illustrates how easy it is for synthetic methanol to be embraced over time as a future fuel for road transport.”

alcohol such as synthetic methanol has the potential to reduce the overall CO_2 footprint of internal combustion vehicles towards zero. Produced through CO_2 recovered from the atmosphere and given a tax incentive, it immediately becomes a green, cheap and more desirable fuel.

Synthetic methanol also possesses properties better suited to internal combustion than today's liquid fuels, giving improved performance and thermal efficiencies. And it is ideal for pressure-charging (turbocharging and supercharging) already being introduced by manufacturers to downsize engines in a bid to improve fuel consumption.

The Lotus Exige 270E Tri-fuel technology demonstrator illustrates how easy it is for synthetic methanol to be embraced over time as a future fuel for road transport. It demonstrates that only small changes to engines are required, such as:

- sensors to detect alcohol content;
- modified software for engine management control driving alcohol/gasoline, flex fuel and fuel systems operations;
- fuel lines compatible with alcohol fuels;
- higher flow rate fuel pump and injectors;
- fuel tank material, compatible with alcohol.

In addition, as a liquid which is miscible with gasoline, synthetic methanol can be transported, stored and sold to motorists exactly as today's liquid fuels are, with only minor modifications.

Synthetic methanol is better suited to spark-ignition combustion than today's liquid fuels, delivering better performance and thermal efficiencies, due to its higher octane rating giving it better resistance to 'knock'. As a result, it is a fuel that will benefit the motorists in terms of driving experience. For example, the Exige 270E Tri-fuel is quicker to 60mph from standstill and has a higher top speed when using 100% synthetic methanol fuel than with conventional gasoline.

The Exige 270E Tri-fuel, with its supercharged 2ZZ-GE VVTL-i engine, could be the forefather of a new generation of conventionally driven cars that have the potential to be environmentally-neutral.

Cars running on CO_2
A vision for future transport

> “What is the way forward? Lotus Engineering regards sustainable alcohols as the third step in a process towards carbon neutral driving.”

Lotus Engineering’s work in this area has not been done in isolation. It has been important to understand the wider implications that affect the viability of synthetic alcohols. Those who Lotus has engaged within this research include the University of Sheffield and the Royal Society of Chemistry’s Alternative Fuel Symposium Series, the Low Carbon Vehicles Innovation Platform, developed by the Technology Strategy Board. Tony Ryan, ICI Professor of Physical Chemistry at the Department of Chemistry at The University of Sheffield, sees the potential for synthetic alcohols, saying: “There is a great opportunity to develop methanol as a transport fuel in a mixed energy economy that embraces a wide range of primary energy sources, including nuclear, solar, and other renewable power sources. Combining atmospheric CO_2 with hydrogen to form methanol provides a pathway to personal transport with low carbon emissions that uses the existing liquid-fuel infrastructure and Lotus Engineering offers world leadership in the development of engines to use these fuels of the future.” Meanwhile, David Bott, director of Innovation Platforms within the Technology Strategy Board in the UK, has said: “The approach taken by Lotus Engineering is a good balance between the desire for the lowest carbon emissions and the practicality of car evolution. The drive for low carbon transport is a real imperative and its progress will require short, medium and long-term solutions.”

What is the way forward? Lotus Engineering sees sustainable alcohols as the third step in a process towards carbon neutral driving. The current E85 (85% ethanol and 15% gasoline) based movement represents the first stage in building momentum towards sustainable fuels. The valuable learning from the current bioethanol vehicles on the market means that synthetic methanol would easily be managed technically and within the existing transport, storage and distribution infrastructure. The steps towards a synthetic methanol economy for transportation fuels could be as follows:

1st Generation: there are a handful of current bioethanol models on sale around the world. These cars run on E85 bioethanol, which is produced from valuable arable crops (food). This is unsustainable in the short and medium term as global demand for fuel will outstrip the supply available from farmland to the detriment of food production, but is a necessary step in the evolution of the market.

2nd Generation: the next-generation bioethanol fuels will be based on biomass waste, for example crop stubble, waste vegetable-based oils and any biodegradable waste matter. This is thought also to be unsustainable in the medium to long term as the required volume of biomass increases beyond that which can be supplied.

3rd Generation: sustainable alcohols such as synthetic methanol can be introduced due to its miscibility with ethanol and gasoline. This fuel can be produced from entirely sustainable, readily available inputs, with an environmentally neutral overall impact.

4th Generation: Direct methanol fuel cells. Over the longer-term, sustainable alcohols in internal combustion will facilitate the soft introduction of direct methanol fuel cells as a long-term sustainable future fuel. This will only be possible with pure methanol pumps on the forecourt which internal combustion engines can bring forward due to their ability to consume a mixture of fuels.

It is clear that governments, fuel suppliers and car manufacturers have a key role to play in the adoption of sustainable alcohols as a future green fuel. If car manufacturers were incentivised to produce next generation models for introduction over the next five to ten years as flex-fuel vehicles capable of running on any mix of gasoline and bioethanol, there would be no need for an unfeasible instant global changeover. Late software changes can permit the introduction of methanol and fortunately, E85 bioethanol and subsequently synthetic methanol can be introduced gradually to the marketplace, due to their miscibility.

Should fuel suppliers increase the industrial-scale production of synthetic methanol, it could be introduced to forecourts across the globe within 15-20 years and eventually become a global standard. That is an exciting vision for Lotus and the industry to pursue.

Source: Lotus Engineering

Interview with Victor Nacif

Nissan Design America

> More of the downstream process is for Farmington Hills and more of the upstream innovation and exploratory process is for San Diego.

Victor Nacif is vice president, Design Business Aspect, at Nissan Design America, Inc. (NDA) the San Diego-based design studio for Nissan in North America that counts the 350Z among its design successes. He joined NDA in 2004 and his areas of responsibility are wide-ranging, including the design process, modelling, technical design and human resources. just-auto's Editor Dave Leggett recently caught up with him.

DL: What's taking up your time at the moment?

VN: There are a lot of meetings and time being used up for the organisation, for making sure that everybody is communicating correctly and for putting in place a team that I think is very, very high-performance all round. It's really more the people side of the design business, than it was before when I was sitting down and sketching and drawing as a designer.

DL: So how much time do you spend involved on the creative side as opposed to the management side and being involved with the process?

VN: In our organisation we have Bruce Campbell who is responsible for the design and I am responsible for the 'design business aspects' here at Nissan Design America. In my area of responsibility I am responsible for all digital design, technical design – so it's the visualisation group, the scanning and milling group and I have HR and administration and I'm also responsible for the clay modellers who obviously work in the creative process from the very beginning with the designers.

We review models on a daily basis – not to interfere, but just to review – and then I obviously do a walk-around of the studios.

The studio in San Diego where I'm based, I'm here two weeks out of the month; and then one week normally I'm in Farmington Hills, Michigan, and I do exactly the same process…. I do walk-arounds on a daily basis, to be inspired by what that team is doing and it's just great to see what they are doing.

DL: What's the division of responsibility between San Diego and Farmington Hills?

VN: The studio in San Diego was set up some 29 years ago as a think-tank, as a creative and innovative environment by which a group of designers from Asia, Europe, America and South America would meet and would create, based on culture, based on diversity and based on the influences that were happening in Southern California at the time.

Interview with Victor Nacif
Nissan Design America

> But the process itself, I see it as more of a guide when you are in the creative stage; you don't have to adhere to it line for line.

That all still holds true today. It is still a very, very innovative place to be. And it's more than the weather – it really is a place where cultures meet and cultures create.

Farmington Hills was created because we have our technical facility there, where there is engineering, there's a small group of product planners there – and consequently what we have is more production-oriented design.

More of the downstream process is for Farmington Hills and more of the upstream innovation and exploratory process is for San Diego.

DL: How much potential is there in the future to further reduce design times and does that mean fewer designers are needed?

VN: Not necessarily. What is happening in the industry is two-fold.

One is that we are getting a greater amount of diversity in a shorter amount of time. In other words, we're coming up with a broader spectrum of ideas but now it's more focused and only in a specific timeframe.

The second thing I see is that the process itself is pretty consistent once a design is chosen – by that I mean the manufacturing process and the supplier process; it's pretty clear. You know when the tooling has got to be done, when the plant's got to be geared up – and I think from company to company everybody is pretty close on that.

The difference in the process is that as you go more towards the exploratory stages and the innovatory stages it tends to be a little more vague and the reason it's more vague is that the process itself early on is more of a guide. Things get really serious when you are choosing from two final designs or you are down to one design. At that point you are going in deep to the fit and finish issues, the digital process – that is pretty tight all around for everybody.

But the process itself, I see it as more of a guide when you are in the creative stage; you don't have to adhere to it line for line.

Creativity, I think – and I believe most designers will tell you this – is not planned. You don't say 'from nine to five you are going to be creative and you are going to have this output for that day'.

Sometimes we have nothing for the first few weeks and then there's the idea – it comes through. Sometimes we get it at the first shot and then we still question it – is it true? Did we get the right answer in the

first place? And then we go through different stages of exploratory work to confirm whether what we came up with initially is right or wrong.

DL: And the design process itself is constantly evolving?

VN: Yes.

DL: Can you describe an ethos for NDA and what do you see as the key things needed in order to design the right products for the North American market?

VN:. When I first I arrived at NDA I heard three elements and I started analysing them – not just to take them in but to actually incorporate them into the way that I am.

The first thing that we talk about in NDA is design excellence. The second thing is inclusiveness and the third is humanistic.

Humanistic is really the people. Inclusiveness is really the process. And design excellence is really the output.

And a strong cultural value here at NDA is that you cannot create in isolation. You have to have highly-creative and highly-motivated people.

The chances of getting a good outcome are much higher when you have those first two elements as bases and you thrive by encouraging design excellence in everything you do – and that's throughout the whole process, by the way, it's not just San Diego having design excellence, but also Farmington Hills.

Biography:

Victor Nacif is vice president, Design Business Aspect, at Nissan Design America, Inc. (NDA). His areas of responsibility include Process, Perceived Quality, Modeling, Technical Design, Administration and Human Resources at NDA's two design studios, located in San Diego, California, and Farmington Hills, Michigan.

Since joining NDA in June 2004, Nacif has been engaged in instilling better practices and organised methodology for increased efficiency and effectiveness for better coordination among Nissan Design affiliates worldwide. Nacif participates in the Joint Design Policy Group with Renault, helping to develop and implement best practices within the Alliance.

Nacif has a truly international background. Prior to joining Nissan, he worked at PSA Peugeot Citroën in France for nine years in various capacities, eventually as the Director of Design from 2000 to 2004. He has lived in the US, England, Italy, Germany and Japan while working at Ford Motor Company for 16 years in various design management positions.

Like many of his colleagues at NDA, Nacif is passionate about sports cars and all aspects of design. He participates in various Art and Design School juries as well as local car shows where enthusiasts meet to share in the passion of classic vehicles.

Born in Mexico City and raised in Oaxaca until the age of nine, he was primarily educated in the United States, graduating from College of Creative Studies, Detroit Michigan. Trilingual in English, Spanish and French. He and his wife Dominique have a son, Stefan.

Even when you are designing the last half-millimetre it takes sensitivity and it takes knowledge of what you are doing to make sure that it improves it or enhances the thing that you are building.

Those three elements are the cornerstones of NDA.

DL: How do those NDA values you have just described relate to broader values in design within Nissan as a whole?

VN: The design values are different from design studio to design studio within Nissan.

Interview with Victor Nacif
Nissan Design America

> “Cars are getting bigger and chunkier because more features are being added and because legislation in occupant protection adds dimension and weight.”

For example in NDC which is in Japan, CBI Creative Box, which is in Tokyo or Nissan Design Europe…they have different values and different cultures but what we try to do is not have the same values anyway, because that gives us a different voice.

We have our own voice and it’s almost like children in a family – there is the family but every child has their own voice and not everyone thinks the same.

The design studios that try to become the same, with the same culture, values and points of view, are the ones that become very, very stagnant.

Even between San Diego and Farmington Hills, the culture is different and it’s more than just the change of weather, temperature or location. They really are very different and we have to honour that. The more we try to make them the same, the less we can leverage the unique perspective each studio can provide.

DL: Does any particular NDA-designed model stand out for you as the epitome of what you are trying to achieve?

VN: Obviously we have done quite a few products here and there are products that are going to be coming out in the very near future that have been inspired and designed by NDA.

Probably the one that I can tell you that’s the safest bet is today’s 350Z. It was designed here at NDA and it was a very interesting process. It was a couple of years before I arrived here and it was designed by a multi-cultural and diverse group of people. The inspiration was Ajay Panchal who is a British designer. He created that initial inspiration, but he didn’t then do it all himself. There were Japanese designers who came on board, there were American designers and there were some Brits and that made it very interesting and compelling. I think NDA is exactly that.

We used to be called, by the way, Nissan Design International and we’re more diverse now and we’re called Nissan Design America!

But I think the case in point would probably be the Z, which was very inspirational.

DL: Do you think the vehicle market globally is becoming more or less diverse?

VN: The fundamental cultural expectations have changed in this industry.

Before, you had the European market – which was basically Western Europe. Then you had the US and you had Asia – which was basically Japan.

But now there are huge variations that are increasing. Western Europe is getting smaller in the marketplace; in the US light vehicle sales have gone from 17.6m down to 16m and this year could decline to about 15.5m. And in Japan, sales have been stagnant or falling for a number of years.

Places that are blossoming are India, China, South America, Central America and Eastern Europe. That’s created a big shift.

What I see in terms of cars is that there will always be diversity.

Some of the diversity is not visible, but for example, the way the suspensions are set up between England and the US is very different – even though it may be the same car.

I worked on the [Ford] Mondeo programme when I was in England – I lived there for five years in the early 90s – and Ford was trying to do this ‘world car’. What happened was that it created a compromise. It was not exactly, at that time, the right size for Europe and it was way too small for the United States.

Probably, in today’s day and age, the differences would not be as great as they were 20 years ago – but they are still there.

Interview with Victor Nacif
Nissan Design America

> I think our laws need to change and they need to change in a fundamental way to allow innovation to grow and nurture.

The features will probably be different because culturally there are certain things that the US market wants, in terms of features or colours or materials, that are different to what Europeans want.

Right now I am seeing a backlash here from the traditional thought that the European cars had better taste and were better vehicles than the American cars.

DL: From consumers?

VN: Yes, led by what consumers want. If you look at a Mercedes or BMW, for example, there's a lot more bright work than there used to be in those cars. In Europe that was unheard of….now there is more interior chrome, more wood, polished aluminium. Before, the European interior was very stark, very basic, very functional – kind of like an aircraft cockpit.

So, culturally, things have changed and I also think there will still be diversity.

DL: Does that mean there's a need to rebalance and look at where market growth is coming from and adjust accordingly to, say, tap into the design creativity in a newly important market such as Russia?

VN: Sure. I participated – and will participate again this year – in the Michelin Challenge which is open worldwide to students of automotive design who come up with ideas. The last time there were 350 entries from over 150 countries.

We're dealing with people who have never even driven a car, in places like Afghanistan, drawing automobiles. You know that they have never had that opportunity and yet they are coming up with ideas.

But all sorts of countries – like Brazil, like countries in Asia – all sorts of countries are now savvy in automobile design.

DL: What do you see as the big challenges and pressures for automotive designers these days?

VN: Needless to say we all have to play by the same rules, but design is becoming harder these days. The increasing restrictions acting on designers are sometimes in conflict, too.

At one end of the scale we're being told that we have to have a more economical vehicle – which makes all the sense in the world – but at the other end of the scale, by the time you add all the safety features that add weight and compromise aerodynamics when hoods have to go up…pedestrian safety is obviously important, but what does it mean for aerodynamics?

Cars are getting bigger and chunkier because more features are being added and because legislation on occupant protection adds dimension and weight.

Over the last 75 years we have found more and more constraints.

I think that if we look fundamentally at the automobile and the essence of what the automobile is as a product, where is the innovation? What is the essence of what this product is supposed to do? What are the different products we can put in the market for those different needs, and then have laws that complement that and not prevent it from happening…

For example, look at three-wheeled vehicles. What is preventing us from doing a three-wheeled and inexpensive vehicle? Well, in the United States you can't go with a car that costs US$2,500 because by the time you add airbags and side protection, a certain amount of engine performance and air-conditioning what do you end up with?

You end up with a car that now costs US$10,000 and weighs 300kg more than was originally conceived.

I think our laws need to change and they need to change in a fundamental way to allow innovation to grow and nurture.

DL: Do you think the regulatory environment can change in the way you would like it to?

VN: Well, it won't come from the regulators. An outside force will be needed for that to happen.

For example culturally, if we look at different types of automobile…

Let's consider a city car, that gets 80-90 miles to the gallon, or that is hybrid powered, that maybe doesn't need the same regulations as a vehicle that is going to be driven on the freeway at speeds of 75 or 80 miles per hour.

Why do we need to meet the same regulations for these two vehicles with very different usage patterns?

I believe that once we start meeting that kind of diversity our CO_2 is going to go way down. The usage of those types of vehicles will be more appropriate to reducing harmful emissions and improving energy efficiency.

The customers themselves, I believe, will be more at the leading edge. It's not going to be the government that changes these things – it's going to be the customers.

The customers are going to be demanding certain things and we need to put pressure on the regulations to change and to allow things to happen.

DL: How do you see developments in the US light vehicle market in the long-term? What trends do you see emerging?

VN: Probably the biggest trend is the huge sensitivity towards the environment and that is a trend that I hope never goes away.

We need to act very responsibly…and we, as an industry, are meeting that trend with what I think are compromised vehicles today.

We as an industry are not creating specific solutions today that I think could be much more compelling. We will in the future programmes.

Generally, I think the US market is going to go through a fundamental shift of saying that if we want the vehicles we had before, we're either going to have to pay for them and we need to look at what vehicles are more appropriate to our needs.

Interview with Victor Nacif
Nissan Design America

> US is an interesting place in that culturally we believe that the bigger something is, the better it is. Bigger is more.

And I believe that in US, because it's culturally very acceptable to have more than one car, you will have families that instead of having, say, two pickups or two SUVs, they might have one SUV for their weekends and a smaller less expensive vehicle for everyday use.

That's a huge trend.

And then secondly there are interiors. If you look at trends – materials, fit and finish, quality, technology and entertainment – we're only at the tip of the iceberg in terms of where that is going. I think it's going to change fundamentally over the next ten years.

DL: To pick up on the environmental concerns, do you think that means more small cars in America?

VN: I don't think it is just smaller vehicles…

US is an interesting place in that culturally we believe that the bigger something is, the better it is. Bigger is more.

If you can offer something bigger for the same price that someone is offering something smaller, even if the smaller offering is better quality – the smaller offering is simply not an inspiration for today's US culture.

DL: But is that cultural dynamic changing with consumer gadgets like the iPod where high value and functionality is increasingly associated with small size?

VN: That's probably an element that will influence it, I agree, but I don't think it will change it though.

If a person has the ability to buy a home or vehicle and that home or vehicle is bigger than the ones they are comparing it to, most people – at least in the US – will opt for bigger.

It's just a fundamental cultural fact. If you have five acres of land, that automatically should be more expensive than three acres of land – even if the five acres of land is in the middle of nowhere.

That's my perception of the way things are in the United States, so I'd be cautious in projecting how the market plays out in terms of, say, smaller cars.

DL: Final question – what gives you the most satisfaction in your job?

VN: Design. I hold the title VP, Design Business Aspects. I've been in this business 28-29 years and was a working designer for maybe six years and have been in management ever since. My passion and everything I do, inside work and outside, leads to design in general and automotive design. It's not just automotive design it's everything. I love design in all aspects, architecture, fashion, colours – and I love automobiles. That's what drives me, 24 hours a day.

Source: David Leggett, just-auto editorial

Low CO_2 with high performance
is affordable and available

> “Produces performance figures that are comparable to market leading C-segment cars with larger engines.”

Lotus Engineering and Continental Division Powertrain (formerly Siemens VDO) have now announced the results of their ‘Low CO_2’ research collaboration. The Low CO_2 vehicle concept is being proposed as a practical option for manufacturers to reduce their fleet average CO_2 emissions.

The Low CO_2 vehicle concept is demonstrated in an Opel Astra and uses a Lotus Engineering-designed pressure-charged three-cylinder 1.5-litre gasoline engine integrated with a number of Lotus and Continental technologies. It features an innovative integrated exhaust manifold design, centrally-mounted injectors, cam profile switching for lift and timing, a high pressure fuel pump, and a mild hybrid drive. The Low CO_2 Astra produces a g/km CO_2 reduction of 15% against the naturally aspirated 1.8 litre four-cylinder engine version of the same vehicle. While forging comparisons to the most frugal B-segment cars, the Low CO_2 Astra – on the NEDC (New European Driving Cycle) – produces performance figures that are comparable to market leading C-segment cars with larger engines. The primary objective of the Low CO_2 project was to deliver greatly reduced CO_2 emissions while maintaining an engaging driving experience from

Technical specification of the Low CO_2 engine when installed in Opel Astra:

Cylinders: 3

Displacement: 1.5 litres

Bore: 88mm

Stroke: 82mm

Compression ratio: 10.2:1

Fuel pump pressure: 200bar

Emissions (NEDC): 149g/km CO_2 meeting Euro V Emission standards

Max power: 160ps @ 5000rpm

Max torque: 240Nm @ 2,500-4,000rpm

Mild hybrid motor output: 12kW

Mild hybrid energy storage system: 60V supercapacitors

Key features of the Low CO_2 engine in detail:

CPS switching tappets:

Lotus Engineering’s Cam Profile Switching system incorporates lobed tappets that vary valve lift and timing. The Lotus system is produced under licence by INA and is used by Porsche in its ‘VarioCam Plus’ system.

High pressure fuel pump:

Continental Division Powertrain’s single cylinder fuel pump driven directly from the tri lobe cam on the exhaust camshaft.

Fuel injectors:

Affordable, 200bar, solenoid, DI centrally mounted injectors by Continental Division Powertrain.

Smart coolant pump and demand regulated intank fuel pump:

Continental Division Powertrain’s electric water and fuel pumps could save up to 2% of fuel.

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> Lotus brought to the project its world-class powertrain design, development, testing and validation capabilities

Performance Data

	g/km CO_2	Torque	Power
Lotus/Continental LowCO_2 three-Cylinder 1.5l Opel Astra	149	240 Nm/177lbft	160ps/118kW/158hp
Opel Astra four-Cylinder 1.8l	175	175 Nm/129lbft	140ps/103kW/138hp
Typical four-Cylinder 2.2l DI engine	N/A	220 Nm/162lbft	155ps/114kW/153hp

Relative improvement demonstrated by Lotus/Continental Low CO_2 Concept

Improvement of Low CO_2 concept compared with:			
Opel Astra four-Cylinder 1.8l	15%	38%	14%
Typical four-Cylinder 2.2l DI engine	N/A	9%	3%

Technical specification continued...

Mild hybrid drive:

The Continental Division Powertrain system features unique water cooled motor housing to match transmission to engine block.

Integrated exhaust manifold:

Lotus Engineering designed and developed a new advanced cylinder head design featuring an integrated exhaust manifold. The production-ready technology can significantly reduce manufacturing costs, emissions and weight on most gasoline-engined passenger vehicles. An integrated exhaust manifold has potential:

- Reduced parts count: 35% fewer components resulting in lower inventory, production, logistics and aftermarket costs.
- Weight reduction: total system mass reduction of 20% resulting from elimination of separate exhaust manifold.
- Improved engine durability.

an affordable set of technologies. The solution employs a cleverly integrated set of powertrain systems within a downsized overall package.

Lotus brought to the project its world-class powertrain design, development, testing and validation capabilities, with specific expertise in engine downsizing and systems integration. Continental Division Powertrain supplied its extensive experience in powertrain management and control systems, especially in the areas of direct fuel injection systems, hybrid drives, energy management, emission after-treatment and a number of new technologies.

The collaboration concluded in early February with the completion of extensive dynamometer and road testing at Continental's facility in Toulouse, France and Lotus Engineering's Hethel Headquarters in the UK. The programme was grant-aided through the UK's Energy Saving Trust's Low Carbon R&D Programme funded by the UK government's Department for Transport.

Mike Kimberley, Chief Executive Officer of Group Lotus plc, said: "Through intelligent integration of a range of proven and newly available technologies, we have delivered a car that engages and excites the keen motorist with the superb power and torque figures

and crucially has a lower impact on the environment. The most important part of this project is that the solution is a combination of technologies that are available and can be implemented in next-generation models and with further work beyond the scope of this initial project, dramatic reductions in CO_2 can theoretically be achieved."

Dr. Hans Nuglisch, senior manager of this Low CO_2 project at Continental Division Powertrain, said: "The cooperation with our partner, Lotus Engineering, has shown once again that there is still an enormous potential for additional innovation within the internal combustion engine. Obviously electronics and mechatronics are making vehicles more economical without compromising driving fun. Additionally turbo charging combined with direct injection means noticeably better fuel economy and lower CO_2 emissions for the gasoline engine. With our advanced expertise in low CO_2 know-how, we provide clear benefits for our customers and will further strengthen and improve our role as systems integration experts."

Importantly this project has received support from the Government. Transport Minister Jim Fitzpatrick was enthusiastic: saying, "I am determined that transport should play its part in tackling climate

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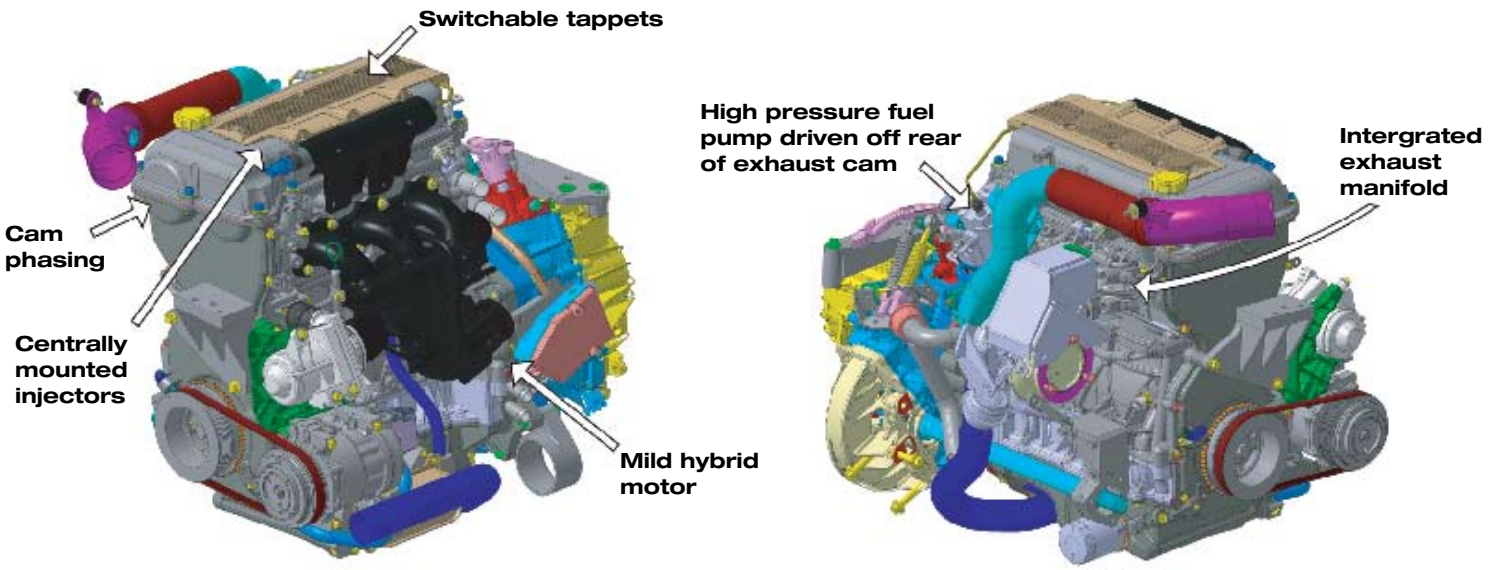

change, so it is essential that our strategy focuses on driving forward new technologies to make engines greener. This engine is one of the more environmentally-friendly petrol engines around, raising the standard for others to meet. I am pleased the Government was able to support this project through the Low Carbon Research and Development programme and look forward to the day when this type of technology becomes commonplace on our roads."

"With over 20% of the UK's total carbon emissions produced by road transport every year, technological advances in this area are vital," explains Philip Sellwood, chief executive of the Energy Saving Trust, which is managing the initiative. "This project is an exciting opportunity for innovative technologies to be developed and showcased."

Lotus Engineering is leading the industry across a number of advanced green powertrain technologies, including electric vehicles, hybrids, biofuels and developing more efficient gasoline and diesel engines. A crucial factor in the adoption of green cars in the future will be ensuring they remain fun to drive. The Low CO_2 collaboration achieves this by a significant reduction in CO_2 tailpipe emissions whilst improving vehicle performance. Most importantly however, the technologies are affordable and ready for immediate application.

Although impressively achieving these objectives, the results do not signify the end of the project, with further advances already underway. Continued development of the engine systems is taking place at Lotus Engineering to further reduce CO_2 and increase engine performance. Continental also plans to continue development of the system model and simulation, develop the software and calibration and integrate the next generation of power electronics to the demonstrator vehicles. With this in mind, the g/km CO_2 output figure could be reduced further, and continue to revolutionise eco-friendly powertrain technologies.

Source: Lotus Engineering

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