

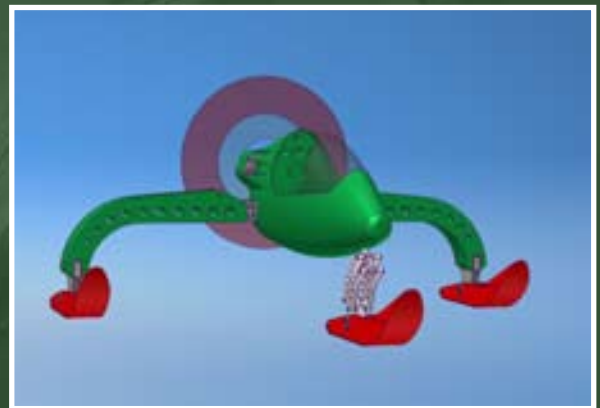


pro **Active**

The official industry newsletter of Lotus Engineering

*Issue 21
July/August 2007*

Polar Moments



Wind Turbines to Supply Lotus Electricity Needs



Welcome

Lotus is unlike any other company. It has a unique culture of its own. Only yesterday a visitor asked me why that is? There is perhaps no definitive answer but there are factors that blend together.

The influence of Colin Chapman and the values he instilled are at the heart of everything we do and are ingrained in our people and our approach. The unusual mix of being both a manufacturer of iconic, world-leading sports cars and a global engineering consultancy brimming with technology and innovation has a part to play. So do our long heritage and emotionally-charged brand.

The culture of the company manifests itself in the enthusiasm of our people to take on new engineering challenges and push the boundaries of how they use their skills in an environment that encourages and supports. The Concept Ice Vehicle for the Griffiths-Moon-Regan Trans Antarctic Expedition, although not actually a Lotus Engineering project, epitomises this perfectly.

Clients that have worked with us recognise our culture is an attractive benefit to working with us; but setting up in new markets poses the challenge of ensuring our new clients receive the same high levels of service in this Lotus way. This was one of many challenges that Ben Boycott had to overcome in establishing our China operations, as he discusses.

These are just two of the features in what I hope you find another interesting and enjoyable proActive.

Peter Morgan

Marketing Manager - Lotus Engineering



Peter Morgan



Contents

July/August 2007

news

- UK: Japanese hybrids face Smart 'green' challenge 3
- GERMANY: Ford Cologne plant passes milestone 3
- US: New models to boost hybrid share 3
- UK: China growth 'unprecedented' 4

features

- Wind Turbines to Supply Lotus Electricity Needs 5
- Polar Moments 6
- New polls and new markets 9
- Market entry: The Lotus way 10
- Software: Is it safe? How do we know? 15
- 'Barbarians at the gate' 17



UK: Japanese hybrids face Smart 'green' challenge

The Toyota Prius and Honda Civic Hybrid are currently top in the UK when it comes to waving green credentials but, in terms of CO2 emissions, this time next year the top two eco-friendly cars will be produced by Smart.

Both models will be based around the redesigned ForTwo city car that goes on sale next month. The first will be badged the MHD, standing for Micro Hybrid Drive, and will arrive in showrooms early next year with a price premium over the standard version. It features stop-start technology thanks to a belt-driven starter generator that cuts the engine when the car comes to halt at traffic lights, junctions and the like.

The MHD will be available as a coupé or cabrio and in all three trim levels, but only with a 71bhp engine. Fuel economy rises from 60.1 to 65.7mpg, and there's a reduction in CO2 emissions from 112 to 103g/km.

That undercuts the Prius and Civic at 104 and 109g/km respectively but the ace up Smart's sleeve for the UK is a ForTwo 800cc diesel with impressive figures of 85.6mpg and 88g/km of CO2. However, there is a downside - it's not exactly what you'd call fast. The two-seater doesn't hit 60mph for 19.8 seconds and top speed is only 84mph ... and it's left-hand drive (as all Smarts were initially when the brand first launched here some years ago).

A spokeswoman said: "We're not expecting a large number of orders but because of the low CO2 emissions it's worth us offering. Like all new Smarts, it will be exempt from the London congestion charge when the emissions-based tolling proposal takes effect." She said the diesel would appeal to urban-based commuters with short journeys who didn't need particularly quick acceleration.

"We will be numbers one and two in the country on emissions, which is a great story for Smart," she added.

Source: just-auto.com editorial team



The new diesel Smart car aims to achieve 85.6mpg

GERMANY: Ford Cologne plant passes milestone



Ford's Cologne plant last year set a production record of 412,688 vehicles

Ford of Europe's plant in Cologne-Niehl has built the two millionth vehicle in the Fiesta/Fusion series.

The two millionth vehicle made on Thursday was a red Fiesta ST destined for Great Britain. Around 74% of the 2m vehicles built were Fiestas. Cologne last year set a production record of 412,688 vehicles, beating 2005's former record tally of 403,000. Almost 90% of the plant's output is exported to 52 countries - the five largest markets being Britain, Germany, Italy, France and Russia.

More far-flung markets include Madagascar, Azerbaijan, Gibraltar, Hong Kong and Mozambique while the Pacific island of Tahiti is considered the furthest from Cologne.

Of the two million Fiestas and Fusions built since 2002, 1.25m were left-hand drive. The start of production of the latest series began in February 2002 after a EUR410m investment to modernise the plant and develop a neighbouring supplier park.

Increased efficiencies have boosted daily production from 1,200 units in 2002 to 1,950 today. The Ford-Werke plant employs 4,200 staff and another 13,200 are at other company facilities in the city.

Source: just-auto.com editorial team

US: New models to boost hybrid share

Hybrid vehicles are on course to achieve record sales in 2007, increasing by 35% compared with 2006, according to the JD Power and Associates 2007 US Hybrid Vehicle Forecast Second Quarter Update.

According to the report, an estimated 187,000 hybrid vehicles were sold in the US market through the first half of 2007, accounting for 2.3% of the total US new light-vehicle market through June. While sales of hybrid vehicles are projected to decline slightly in the second half of the year, the market is still on track to sell 345,000 hybrids in 2007 — a 35% increase from the 256,000 hybrids sold in 2006.

"High gas prices during the first half of 2007, coupled with automakers lowering the price premium for most hybrid models, have given the hybrid market a boost," said Mike Omotoso, senior manager of global powertrain forecasting for JD Power and Associates.

The Toyota Prius continues to be the most popular hybrid model, selling 94,503 units through June 2007 and representing 50.6% of all new hybrid vehicles sold in the US market in 2007. Prius sales were bolstered earlier this year when Toyota began offering incentives of up to US\$2,000 to entice customers.

"Toyota realised that they had to offer incentives for the Prius to offset the decrease in the federal tax break, which decreased from more than US\$3,000 in 2006 to less than US\$1,000 in 2007," said Omotoso. "The incentives helped Toyota maintain a strong sales pace for the Prius."

Despite the entry of nine new hybrid vehicle models into the market in 2007 — seven of which are expected to go on sale between July and December — the Prius is projected to continue as the market leader among hybrid vehicles during the next few years.

Competition in the hybrid segment is projected to intensify further in the coming years. According to the report, there will be as many as 65 hybrid models — 28 cars and 37 light trucks — on the market by 2010, with sales expected to reach nearly 775,000 units, or 4.6% of the total US new light-vehicle market.

"While consideration for hybrids is falling, interest in hybrids is still strong among consumers, and projections indicate steady growth for this segment in the coming years," said Omotoso.

"Bringing additional hybrid models to the market will serve to fuel that interest."

Source: just-auto.com editorial team

UK: China growth 'unprecedented'

China's domestic car market continues to grow at an unprecedented rate.

UK-based analyst Jato Dynamics, whose specialties include tracking vehicle specifications worldwide, said first-half sales for locally built cars were up 46% to 2,965,430 units, year on year. "Chinese manufacturers are posting staggering growth figures," said Jato international sales and marketing director Nasir Shah.

"Precise data is still hard to gather in the market, but it's clear to see that the Chinese car market is expanding at a rate never before seen in an international market. Furthermore, there's no sign of the growth abating."



Volkswagen was China's top-selling car brand

Volkswagen was China's top-selling car brand (up 32.9%), ahead of Wuling (unreported in 2006), Chery (43.6%), Toyota (65.2%) and Honda (30.3%).

"In a fast-growing market such as this, there is significant investment in new products, new brands and in the distribution networks. As a result, many manufacturers have recorded significantly increased volumes over the past year," added Shah.

Jato highlighted Brilliance Jinbei (up 145%), Hafei (174% although full volumes may not have been reported in 2006) and Mitsubishi (98.6%). Of the European brands, Audi (38.2%) and BMW (65.8%) are performing very strongly.

Of the models for which the full volumes have been reported, the market leader is the Volkswagen Santana (up 31%), ahead of the Buick Excelle [a GM Daewoo design] (5.1%), Volkswagen Jetta [a previous generation model], Toyota Camry (a new market entry), Chery QQ (5.3%) and FAW N3.

Jato said Wuling, Chana and Hafei have not reported model totals for all vehicles sold so the performance of their individual models could not be satisfactorily determined. This is significant because the Wuling Sunshine, Light and Hongtu passenger micro-van models may well be competing for the position of best-selling car in China for the first six months of 2007.

Jato also noted that, in a rapidly evolving market such as China, it is common for models to remain virtually unchanged while the brand name changes - (eg last year's Mazda Family is this year's Haima Family).

"The number of domestic manufacturers, some large and some small, is very high, and there is some consolidation occurring within the market. These factors can make comparison of brand performances over time more problematic than in other worldwide markets," said Shah.

Underlining his comments, SAIC and Nanjing, who respectively separately make and sell Roewe 750 and MG-branded versions of what was once MG Rover's 75 line, at the weekend (28th July) announced a new 'cooperation' deal.

Source: just-auto.com editorial team

Wind turbines to supply Lotus electricity needs

Group Lotus plc, the high performance sports car manufacturer and world leading engineering consultancy, has joined forces with green energy company Ecotricity in its drive to minimise its carbon emissions and become genuinely green in its energy supply. Innovative engineering will now be partnered by wind energy to be the power behind the Lotus manufacturing plant in the UK.

Under their Merchant Wind Power (MWP) scheme Ecotricity, the UK's largest independent green energy supplier, has submitted a request for a Scoping Opinion to South Norfolk District Council for their views on potential plans for a wind park at the Lotus Manufacturing Plant and Test Track, at Hethel near Wymondham.

The turbines could provide up to 100% of Lotus' electricity needs. Excess power will be fed into the local grid and can be used by local residents. Switching to a green energy supplier is the biggest single contribution an individual or business can make to help reverse the onslaught of climate change.

Dale Vince, founder of Ecotricity, commented: "This is an exciting project, and I'm delighted that Lotus is taking its responsibility to the environment so seriously. There are many myths about what it takes for a business to become truly green, and the Lotus wind turbine project will be an important example for other organisations. The company won't be spending any additional money on its energy supply, but will have peace of mind knowing that it's part of a growing movement to redress climate change."

Mike Kimberley, chief executive officer of Group Lotus plc, said: "Lotus is globally recognised as a pioneer in vehicle technology and is now working worldwide in environmental and green transport research. By sourcing our electricity needs for our Hethel headquarters in Norfolk from these wind turbines, we can contribute to reducing our corporate CO2 emissions dramatically and provide a definitive demonstration of our commitment to the environment."

Lotus has carried out extensive assessment of its premises at Hethel near Wymondham, demonstrating the potential for a wind park – specifically three turbines located in the centre of the test track. The request for a scoping opinion represents the next stage in progressing the development of the site. It will seek the views and advice of all statutory bodies concerned, such as the Environment Agency, the Ministry of Defence and Natural England.

Source: Lotus Engineering



Turbines could provide up to 100% of Lotus' electricity

Polar Moments

Rather like former Prime Minister Margaret Thatcher, Lotus Engineering's Kieron Bradley hasn't much use for sleep. "My mind is constantly active," reveals Kieron, "and on the weekends I can go 24 or 36 hours without sleeping." This aversion to an activity that most of us deem essential helps explain how he's able to work often lengthy days at Lotus and then after-hours settle down to designing and fabricating a dynamic new vehicle for the Griffiths-Moon-Regan Trans Antarctic Expedition 2007-2008.

Kieron was tracked down by Jason De Carteret a highly experienced polar guide and respected explorer. In December 2005 Jason was part of a polar expedition team founded by Andrew Moon, Richard Griffiths and Andrew Regan that set a new World Record for the fastest surface travel from the coast of Antarctica to the elusive South Pole. The team did this in a Ford Econoline van which was modified in Iceland and converted to a 6x6 with 6-wheel-drive running on massive 44" tyres.

"My mind is constantly active and on the weekends I can go 24 or 36 hours without sleeping"

They smashed the record that stood at 24 days down to 69.5 hours. Jason knew that Kieron had already designed a wind powered kite buggy that had made an attempt to travel from the South Pole to the Coast but the expedition was cut short because of a lack of wind and a pressured time frame. Jason's idea was to change the design of the buggy, give it far more ground clearance and to fit a power unit that would provide the vehicle with "its own wind". Jason and Kieron went through many power plant options and construction designs using Kieron's engineering knowledge and Jason's Antarctica knowledge. They both knew to construct a vehicle that could really handle the terrain and the temperature wasn't going to be easy. Jason even drove the massive 6x6 to show Kieron just how strong the new concept vehicle needed to be and this vehicle weighing 5 tons when empty only just made it.

Plans and ideas came to reality and the "Concept Ice Vehicle" was born. The Concept Ice Vehicle or CIV is a James Bond 007-esque machine that runs on a trio of broad skis and is powered by a tri-blade propeller driven by an air-cooled BMW micro-light engine. And while its looks alone will draw the public gaze to the Griffiths-Moon-Regan Trans Antarctic Expedition, the CIV has a scientific purpose – to test the practical viability of E85 bio-ethanol



Kieron Bradley with the propeller of the Concept Ice Vehicle

in conditions of extreme cold and establish the suitability of a low footprint vehicle in a pathfinder role for larger Science Support Vehicles (SSVs) by carrying ice penetrating radar equipment to pinpoint crevasses long before they arrive.

Kieron's original lightweight, three-ski buggy design clearly had potential and the experience yielded several lessons that have proved useful to the CIV. "Don't use snow scooter skis was a big lesson learned," Kieron cites as an example, "because they aren't sufficiently wide and their tips aren't tall enough to cope with the extremely rough surfaces you find at the South Pole."

Having agreed to provide his services for the expedition, Kieron then had to square things with the boss at his workplace – Lotus Engineering. "Although I would be working on the CIV after-hours, I knew I would need to use Lotus facilities and equipment. So I spoke to Simon Wood (engineering director at Lotus) and he was incredibly supportive; now with time getting tight for the September 1 completion date, Simon has even suggested that I can complete the project in company time."

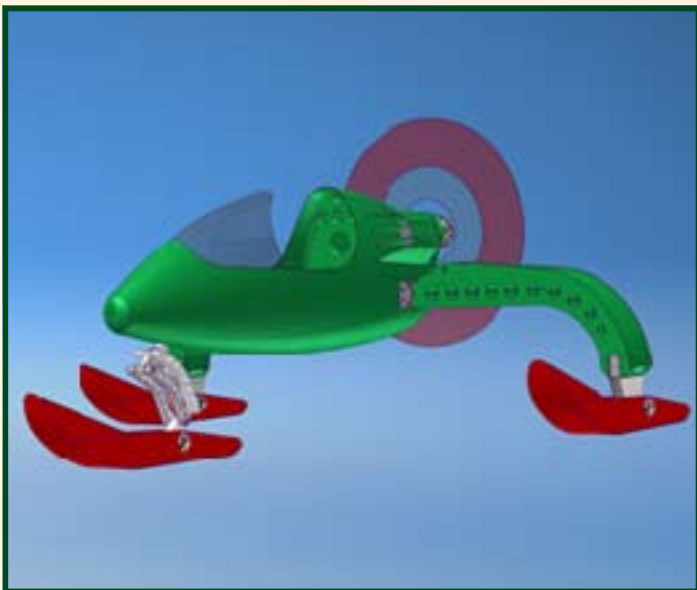
Kieron continues: 'Simon's generosity is a good example of the culture of Lotus where creativity and innovation are always supported. Both Simon and (Lotus CEO) Mike Kimberley enjoy seeing projects where passion and technical expertise are brought to bear. And in the case of the CIV its technologies echo those of Lotus – it uses lightweight bonded aluminium structures, glass-fibre composites and it will expand the knowledge base of bio-ethanol behaviour.

"And it's not just management who are offering support – anyone around here will do anything to help. It has been incredibly useful that there are so many specialists assembled under one roof, because when I need to know about a particular subject I know that the person I talk to will know everything there is to know about that subject."

There are some things that not even Lotus engineers have much knowledge of, however. "As Jason has explained to me," says Kieron, "Antarctica remains one of the world's great mysteries, even compared with the Arctic. So, for example, there simply is no scientific information available about what happens between the skis and the snow when you're 10,000 feet above sea level in very dry conditions and exceptionally low temperatures. What I do know is that there's no liquefaction of the snow beneath the ski, which would normally help you to glide and consequently there's a lot of 'stick'. Just when you think you know exactly what's needed something like that comes along – it's a big learning curve."

To ensure that the CIV doesn't fail in the field, Kieron has over-engineered it to survive at -72°C , with an increase in strength wherever possible, and tested all the major components in the Lotus cold chambers. He has checked the shrinkage rate of every component in every bearing and researched every material used in the CIV to an extraordinary degree; Kieron has received help in this area from a stepbrother who fortuitously is researching how and when materials break. Vibration as well as cold is a potential enemy to the CIV; Jason De Carteret describes riding across Antarctica's corrugations in the SSV, even with air suspension and tyre pressures lowered to 2psi, as "like being inside a washing machine."

Every change to the design has had potential effects on the rest of the CIV. "You have to view a design like a Rubik's Cube – you know what's required to get one side of it all one colour, but in doing so you may well spoil the side you did earlier," muses Kieron. "I've been through eight different ski configurations and six outrigger designs, for instance. Luckily, being able to call upon the expertise within Lotus has in some cases saved me weeks of research".



Concept Ice Vehicle: Front angle view



The challenge that faces the Moon-Griffiths-Regan Trans Antarctic Expedition

One of the key elements of the Trans Antarctic Expedition's research programme is to further improve the understanding, visibility and practicality of renewable bio-fuels. As Jason comments, "if we can use bio-ethanol to get to the South Pole, then you can use it to get to Sainsbury's." Of course, it's not quite that simple, as E85 won't atomise at temperatures below -15°C . But as Kieron points out, extreme cold isn't an insurmountable problem. "The CIV's fuel tank has a heated jacket – as do the E85 storage tanks in the SSVs – but there's little point in having warm fuel if it is then hit by freezing air before it passes through the injectors."

"So it's better to have warm intake air. For start-up the engine is initially fed petrol to get some heat into the engine and this heat is fed into a thermal converter down by the exhaust – a solenoid valve switches over to the E85 supply once the right temperature has been reached."

As accomplished as Kieron is at 'virtual' engineering, he is at home in the fabrication shop assembling the hardware he has designed; the grime on his fingers attests to the fact that he's very much a 'hands-on' type of engineer. At the time of our visit he has the aluminium frame for the CIV on a bench to check its alignment, while in another area of the shop sit part-finished skis and outriggers, recently back from being heat treated and awaiting a visit to the Lotus paint shop. One of the elements of the CIV that Kieron hasn't designed himself is the bodywork – that comes from a micro-light (so has been developed to resist cold and vibration) but it has been modified for its new earthbound role.

In another room the BMW 1150S engine is still in its transit packaging but will soon be unwrapped and fitted, while alongside it rests a large, red, three-bladed propeller sourced from a micro-light manufacturer. In a couple more weeks all these assorted components will be built into the finished CIV.

Feature

First stop for the completed vehicle will be as the centrepiece of a press launch in early September to formally announce the Griffiths-Moon-Regan Trans Antarctic Expedition. Then if all goes according to plan the CIV will undergo five days' testing in early November before heading south to the Pole on November 14; the team's goal is to reach the South Pole by November 18, spend four days conducting scientific research there, then set off on a six-day trek to McMurdo Sound.

Final destination for the team is Ross Island and the historic huts of earlier Antarctic explorers, Scott and Shackleton. Because while it's easy to get excited about the CIV from an engineering/car guy perspective, the Expedition plans to do much more than merely wake up the world to the idea of renewable bio-fuels. The visit to Ross Island is to help raise money for the Antarctic Heritage Trust charity that is hoping to renovate Scott and Shackleton's huts and in the process raise awareness of the whole region.



The Concept Ice Vehicle's skis and outriggers in the Lotus workshops

“You have to view a design like a Rubik's Cube – you know what's required to get one side of it all one colour, but in doing so you may well spoil the side you did earlier”

Throughout the expedition the team will be running several educational experiments examining the sub-surface, surface and atmosphere of Antarctica. It will run a mobile weather station, use special UV sensors to chart the size and shape of the Antarctic Ozone Hole, and dig deep into the ice to reveal evidence of past climates in the region. And the expedition hopes to demonstrate how the health of Antarctica has an impact on the whole world's climate. Live webcams will feed back real-time images of how the expedition is progressing and the results of experiments will also be posted on the web as soon as they're completed – keep checking www.corvusexpedition.com for updates.

Kieron is unlikely to be there when his creation sets off into the frozen wastes. He says that he'd like to go down to Antarctica for the five-day test programme, but he's a realist: “Unlike its northern cousin the South Pole is truly unpredictable. Antarctica is about waiting. Everything is delayed. I can imagine five days becoming 30.” And for the man who doesn't sleep, who has to be designing something or making something as a release for all his creative energy, sitting around and doing nothing would be the worst form of torture in the world.

For full details of the Trans Antarctic Expedition and news updates, visit www.corvusexpedition.com.

Source: Brett Fraser

New polls and new markets – the latest from Group Lotus

Supercars and Superbrands

It would come as no surprise to many that the Lotus brand has featured in the 2007/2008 UK Superbrands Index for the first time in many years. Lotus was placed 210th, which is a tremendous achievement and attributed to Lotus maintaining its heritage, innovation, iconic sportscars manufacture and a global high technology engineering services.

Future technology, design and development plans will certainly put Lotus at the forefront of the sportscar market, and the coming years will see a series of new cars. Starting with a mid-range, mid-sized Lotus sportscar, codenamed "Project Eagle", this lightweight, high performer will be available in early 2009.



Lotus and CEO Mike Kimberley feature strongly in new polls

America On Line (AOL) has approximately 50 million subscribers worldwide and, as such, is one of the world's largest internet service providers. It was, therefore, considered a huge compliment to the management and staff of Group Lotus, when a poll in the highly rated AOL motoring section recently placed Mike Kimberley, CEO of Group Lotus, as thirteenth in the Top 50 All-Time Most Influential People in the Automotive Industry. Heading the list was Porsche's Wendelin Wiedeking with VW's Dr Ferdinand Piech in second place.

Mike Kimberley said: "Our third-party high technology engineering business is one of the most successful and prolific in our industry and has an enviable global reputation. Our standing in these polls is clearly a reflection of this, as well as the passion and enthusiasm that surrounds our wonderful brand."



Lotus expands to South Korea

South Korea - the latest market to join the Lotus family

Continuing its expansion into new markets Lotus Cars has appointed LK Co., Ltd for the retail of Lotus cars in South Korea.

The first allocation of nine hand-built Lotus cars arrived in South Korea in early July in time for the fantastically glamorous brand launch at The Circle Super Club in Seoul. Also at the launch event, last year's British GT3 Championship-winning Lotus Sport Exige GT3s to showcase Lotus racing technology and demonstrate the strong link between race and road products.

The new Lotus showroom will be located at 563-17, 1/F, Shinsadong, Gangnam-gu, Seoul 135-891.

Source: Alastair Florance, Group Lotus



Feature

Market entry: The Lotus Way

Nowadays many organisations are seeing the euphoria of trail blazing into the Chinese market turning into the challenge of execution. Lotus Engineering has approached this with the adaptability and responsiveness that has come to characterise Lotus.

During the growth of its operation in China from launch in 2004 to the thriving business of today, Lotus has quickly overcome many of the obstacles that result from entering new and unfamiliar markets. Such activities range from adaptation of our process to completely rethinking our delivery mechanisms in line with the differing needs of the Chinese OEMs (original equipment manufacturer).

The objective has been to integrate the China operation into the organisation in a way that brings cost and efficiency benefits to our clients the world over whilst at the same time ensuring our products and services are relevant to the marketplace.

“Lotus Engineering has approached this with the adaptability and responsiveness that has come to characterise Lotus”

This article discusses two aspects of the Lotus business in China. Firstly it is a review of how Lotus Engineering managed to transfer and tailor its project execution to China without diluting its core values. Secondly it is a discussion of some of the broader challenges of doing business in China.

Maintaining Lotus core values: The Lotus DNA

Since the inception of the company in 1948 Lotus has maintained the same guiding principles of its founder Colin Chapman. This Lotus DNA pervades every part of the company, is a key to the success of the group and is based on core values including engineering vehicles that are fun to drive, innovative and obtain performance through gains in efficiency and through light weight.

It is part of the Lotus philosophy that all of our product development carries with it part of the Lotus DNA. Because of this, the first and

“The “can-do” attitude of the Lotus engineering staff has proven to be a real asset to the group”

potentially most important challenge for Lotus was to ensure that the core values of the company were maintained during the localisation of our delivery.

In this respect, the “can-do” attitude of the Lotus engineering staff has proven to be a real asset to the group. It has enabled us to quickly adapt our policies to facilitate the relocation of project leadership from the Lotus facilities to the client site without dilution of our core values. We have achieved these through i) development of bespoke delivery models and ii) global resource management.

Development of bespoke delivery models

Looking at the development of consulting engineering services over time it is possible to define the stages of project delivery in terms of several models.

Each of these can be seen as a stage in the evolution process as companies localise their services in China, as follows:

- Delivery of projects wholly outside of China - the “Over the Wall” model
- Delivery of projects partly inside China using own invested technical facility with a joint embedded Lotus and local team - the “Technical Centre Model”
- Delivery of projects in China at the client site using embedded lotus chief engineers and technical experts - the “Lotus Triangle Model”
- Delivery of projects in China at the client site using local Chinese chief engineers and technical experts - the “Localised Lotus Triangle Model”

In the past Over the Wall delivery has been the only route available due to the location of high quality facilities and trained personnel. Recently with the completion of engineering technical centres in China, projects have begun gradual migration into China.



Feature

Whilst this does bring projects closer to the clients it still does not solve the significant requirement for training and technology transfer, principally because it is still not efficient for a manufacturer based in one city to send a large number of its engineers to a facility in another city.

In addition, after significant investment in facilities, local manufacturers are required to show acceptable returns against those facilities. The market pull is therefore towards on-site delivery with teams made up engineers from both sides, delivering the project within the client's organisation and utilising the client's facilities; this is where the Lotus Triangle Model applies.

The key driving elements and the benefits for the shift in focus towards on-site delivery can be summarised as follows:

- Provides training and knowledge transfer to client engineers
- Politically seen as an "in-house" project
- Reduces project costs through utilisation of the client's engineers and facilities

Global resource management

To maintain the group's focus on the core objectives of the strategy, Lotus has put in place a strong global resource management team. This team co-ordinates the project activities according to the strategic objectives of the group.

The principal decisions about project structure and location are made according to guidelines for:

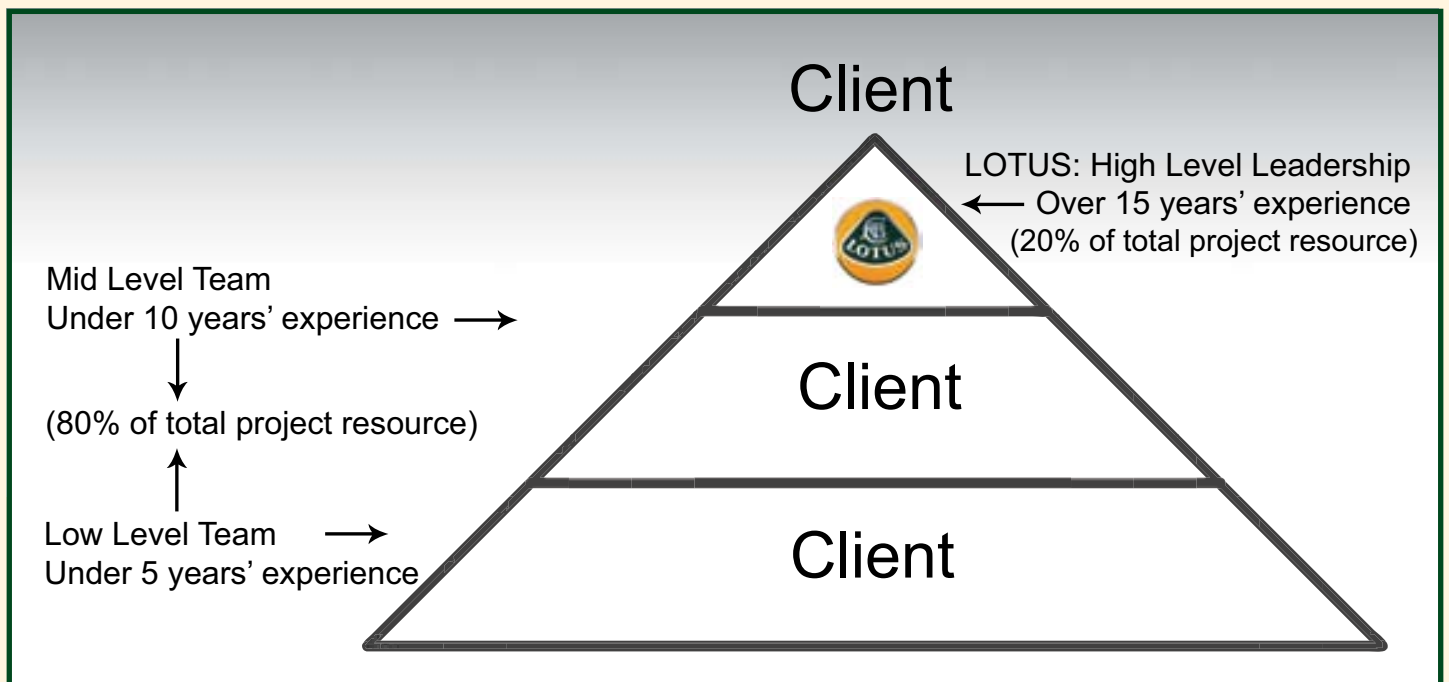
- requirements for growth of capabilities in a certain region
- maintenance of global technical leadership in a certain location
- utilisation of the group's global resources to maximise value for the client

This structure provides clear guidance for all of the global activities within Lotus and has been effectively used to bring together potentially competitive teams in to one focused unit.

Key to Lotus' successful global resource management and Triangle Model is having flexible and committed senior engineers who are willing to run projects at the client site. Whilst overseas placements are recognised as a distinct benefit for the development of staff and career progression, for many of the Lotus team it could mean their first visit to China, a country with a quite different culture. To ensure staff can quickly adapt to the new experience and 'hit the ground running', Lotus has been developing a system of cultural training for both before and during assignments, supplemented by a mentoring process with 'old hands' giving guidance and support.

Key challenges of doing business in China

Execution in China means challenges at all levels within the organisation, from the staff on the ground to the board of directors. Two of the most challenging aspects that Lotus had to address and that any organisation has to come to terms with are the flexibility and



The Lotus Triangle Model

Feature

decision-making processes, followed by the payments and taxation processes in China.

Flexibility and decision-making

Whilst in some western countries slow or indifferent service is often accepted as just 'how it is', in China service needs to be attentive and immediate at all times. Anyone who has eaten in a restaurant in China will know that the waitress will stand with you during the review of the menu to advise on the dishes and answer questions. In addition the restaurant can easily accommodate changes to the ingredients or cooking method according to the client's request.

The dining experience in China is perhaps a good place to gain an understanding of standards for service in China. Applying these standards to how western companies provide service can reveal large differences in the cultural expectations.

Service and flexibility need to be constantly improved to maintain customer loyalty in today's market. China is currently (or at least is perceived as) a buyer's market with an ever-growing number of new entrants vying to gain market share. As such company buyers have come to believe themselves rather omnipotent. This feeling is supported by new entrants offering products and services at very low or zero margins in the belief that this will gain market share. However setting pricing with the expectation that it can later be revised upwards is a risky approach in China because of the number of new entrants and also because of networks between key players in the industry.

Even assuming that your company can provide the best possible service with a high degree of flexibility, local companies' internal policies can make your progress feel slow. Local manufacturers' internal processes are often very complex and hard to navigate and can be fraught with unforeseen complications. This is true in all companies but especially so in the very hierarchical state-owned manufacturers. In the face of such processes, data is requested in advance of the timing requirements to give time contingency and ensure no delay in the process.

The feedback cannot be given until the process advances but in the case of contingency stack-up this may be some time. In addition, due to the inexperience of buyers the assessing teams are often learning the subject in parallel to the selection process. The result of this is that activities can come in rapid-fire bursts varying team workload from idle to maximum effort with little in between. In some cases, with companies trying to gain an entry into the market in China their organisations are permanently at full speed in an effort to cover the vast number of manufacturers in China. In the last three years Lotus has developed standard offers and streamlined processes to allow rapid responses without overstressing internal teams and managing the workflow gives the added benefit of consistency.

The hierarchical nature of the business environment in China also affects the ability of organisations in China to respond quickly.

In the west, organisations use flat structures and high levels of empowerment to scale the business and enable quick reactions. Juxtapose this with the average Chinese organisation which separates the doers from the deciders with layers of structure and administration.

Whilst it is easy to conclude that adopting the western approach would be a fix, let's not forget that behind many of the issues in China there are the fundamental drivers which cause some organisations to make decisions that seem to be difficult to understand from the outside. If you consider that China needs to create one million jobs a year just to maintain the status quo you can easily understand why the west's ruthless pursuit of efficiency and profit may not be primary objectives of some large organisations.

“China needs to create one million jobs a year just to maintain the status quo”

The use of unconventional solutions and processes, if not managed well, can be another area that can be perplexing to organisations tackling the China market. For example, there may be bid processes where the negotiations with the winning party take place well in advance of the actual bid meeting. Alternatively there are bid processes where winning the bid is actually just the ticket to begin the negotiations. It can be very hard to explain to other parties within your organisation why having won the bidding process it is then necessary to begin the sales process proper.

Similar issues can occur during discussions around new product development processes. Chinese manufacturers have process, timing plans and cost targets that western manufacturers have difficulty to comprehend.

Perhaps the conclusion is that there is still a lot to learn on both sides. After all who can say the other processes don't work when there are cars from all manufacturers selling in high numbers.

Payments and taxation

Chinese companies have a reputation for being poor payers. Though not all companies deserve this, as a generalisation it exists. It may be due to cash flow or the status of your relationships within that organisation, your "guan xi". Some blame the different processes demanded by the varied provincial and municipal government departments before they allow a release of foreign currency or



provide tax-free certification. There are many excuses but it is often hard to deny the fact that sometimes a significant amount of a company's profit can be held in aged debts. Boards have a right to be worried and putting in process changes is now the minimum standard.

“Rules are for the interpretation of wise men and the obedience of fools”

With regard to taxation, anyone who is in the process of dealing with Chinese corporation tax will be able to sympathise with one of Colin Chapman's (Lotus' founder) favourite expressions, namely “rules are for the interpretation of wise men and the obedience of fools”. The question is whose advice do you take? The board-friendly option would be to take the safe route and follow the advice of one of the international consulting firms, on the premise that ‘no one gets blamed for choosing IBM’. On the other hand a brave person may decide that using local agents with good ‘guan xi’ may make the board nervous but could net significant gains to the company in the long run. It is worth remembering that everything in China is negotiable and this includes taxation. Mercedes Benz, for example, achieved 0% import tax on their CBU vehicles apparently because the supplier base was not adequate to deliver the quality required, or could it be because they just negotiated well?

The above are just some of the ideas and examples that Lotus has learned from its development in China. It would be easy to write a book about these experiences but perhaps the key learning is this: taking brave steps to embrace the culture and localise products and services may be challenging to execute in the short term but long term will bring significant benefits.

*Source: Ben Boycott,
General Manager, Lotus Engineering China*



The home of Lotus Engineering China in Shanghai

Software: Is it safe? How do you know?

From its inception in 1992, Lotus has been a Controlling Member of MISRA, the Motor Industry Software Reliability Association, and before that for two years a participant in the SMMT's Software Reliability Group. As systems using embedded software have become dramatically more complex, this activity has grown in importance, scope, and sophistication.

Why is this activity so important? Software now pervades almost all control technologies employed in vehicles; even the once humble engine management system is now a complex beast, using algorithms which are beyond the capacity of the human brain to conceptualise and visualise in detail. Whereas there was little that an engine management system could do to cause mischief for the driver of a 1980s car (using a Bowden cable throttle, the only controlled parameters being ignition advance and fuel quantity, and not communicating with any other systems), today its role has expanded.

It 'talks' to and operates in collaboration with a number of other systems, such as electronic throttle, automatic gearbox, clutch, stability control, suspension control, and HVAC. To compound the problem for the human capacity to visualise and comprehend software-based systems, hybrid vehicles are now widespread. In these vehicles software-based systems collaborate in controlling and proportioning torque from multiple propulsion sources and regenerative charging of the battery (aiding braking). This technology is rapidly developing towards individual wheel torque and speed control that provides not only propulsion but also ABS, anti-spin, stability and handling enhancements and more. These involve multi-dimensional algorithms that cannot be visualised without the help of mathematical system-modelling tools and techniques.

Whereas a car of the 1980s had perhaps a few hundred lines of software code, in the 2000s this has become many thousands, even millions. This has posed a major dilemma for software developers and vehicle system designers: how do you know if the software is 'correct'? How can you prove that it is safe? Even a software program of 1,000 lines of code would take hundreds of years to test for every possible condition.

Functional testing is of little real value in this context; it may prove that the system does what its designers intended, but cannot prove that the system does not do what its designers don't want it to do. Without a radical change in custom and practice, and the development of complex software-testing and analysis tools you can't prove that software is safe and correct.

There are no 'ifs, buts, or maybes' about this statement; even with the best tools and practice available, you can only derive a certain level of confidence in the system and its embedded software.

What has Lotus done about this scenario?

In the 1990s, Lotus first incorporated Safety Analysis as part of its safety and system evaluation process of a software-based system. The system in question was the engine management system used on a Lotus product. Safety Analysis is something like FMEA(Failure Mode and Effects Analysis); however, it is carried out on the desired functionality of the system, not on the system implementation. In other words, on WHAT the system is to do, not on HOW it is to do it. The analysis, if used well, aids the system's designers to configure the 'how'.

Adopting this technique, we had no great surprises for the engine management system; but we did identify some potential issues, especially in the system's responses to fault conditions, which enabled mitigations to be developed. During the early 2000s, the safety analysis activities grew to include application to Active systems, and to other client projects. A noteworthy application

“Whereas a car of the 1980s had perhaps a few hundred lines of software code, in the 2000s this has become many thousands, even millions”

was to a client engine project, where a number of potential issues were identified, and corrective actions devised and initiated. This exercise was a milestone in that, for the first time, the techniques used to analyse the issues extended beyond safety analysis per se. A form of Event Tree analysis provided a clear view of the sequence of events leading to a possibly hazardous situation, thereby aiding the identification and adoption of corrective actions.

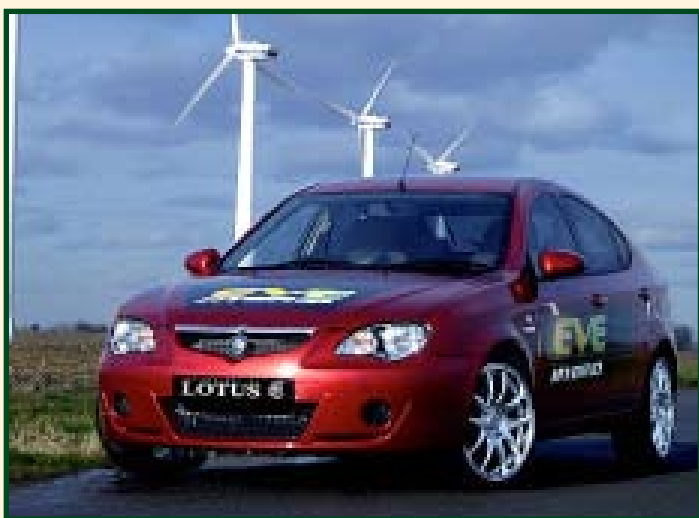
During the last decade, safety engineering has become a major issue for all industrial sectors; the release of the international standard IEC 61508 in 2001 requires that every industry either complies directly with it, or must produce sector-specific standards compliant with it. MISRA has developed a sector-specific guideline (MISRA is not a standards body), which is planned for publication in 2007; currently an ISO standard is also being developed – an activity in which MISRA participates as the UK experts – and this will be released sometime in 2008/9.

Feature

The approach of these standards is two-pronged. The software development process must be formalised, based on a standard 'life cycle' such as that included in IEC 61508. Technical requirements are placed on software development, including:

- the choice of software language,
- the use of 'safe' subsets of standard languages (e.g. MISRA C: 2004);
- relating proving and analysis techniques to the level of criticality;
- provision of structured documentation;
- maintenance of change management;
- stipulating and upholding the competency requirements for safety engineers and software writers of safety-related code.

Lotus has taken this on board, and continues to develop its own experience and techniques, in line with the international standards. Doing so has brought benefits in other ways. A good example is the time taken to carry out FMEAs: safety analysis identifies the CRITICAL issues (all issues are ranked), thus permitting the FMEA to be targeted at those issues, rather than including the minor issues as well. This has been shown to reduce the effort to carry out an FMEA by more than half, a very worthwhile cost-saving – and yet with better results. In addition, engineers doing an FMEA inevitably become bored with all the minutiae involved; a small safety analysis team is much more dynamic, so the team feel more involved and tend to be both more productive and more perceptive of undesirable issues.



Complex hybrid powertrains compound the software safety challenge



The T4 controller - Lotus' first use of software safety analysis in the 1990s

But how do you know it's safe when you have done all this?

'Safe' is a relative term, not an absolute. The aim of safety engineering is to establish a level of confidence in a software-based system, by a set of actions:

- Derivation of a level of probability of a hazard occurring,
- Assessment of that probability, given:
 - The criticality of the hazard,
 - The degree of exposure to it,
 - The likelihood of an average driver avoiding a collision of the hazard were it to occur.

Other techniques are available, such as static code analysis, code metrics, code coverage metrics, 'white' and 'black' box testing, error seeding, boundary value test/analysis, peer reviews of requirements, software code and such considerations as traceability, compliance with design procedures, and quality of documentation, depending on the criticality of the system's functions.

Software engineering has been practised for many years, even though it is relatively new in the automotive industry. The techniques used have been proved by their development and widespread use in the aviation, military, and nuclear industries.

With its long involvement in safety analysis and software reliability in the automotive context, Lotus is well placed for the future as software based systems represent an ever-growing slice of the effort, cost, and risk of automotive engineering.

Keith Longmore, Control Systems

‘Barbarians at the gate’ enter the auto industry

There’s nothing new about private equity firms, but the big groups are getting bigger and growing in influence. Seen by some as avaricious asset strippers with ever-increasing debt in pursuit of a quick buck, their supporters claim they are an essential part of modern capitalism and give busted companies a future. And your pension might depend on their continued success. just-auto.com’s Dave Leggett ponders their recent rise to prominence in the automotive sector.

Private equity groups (PEGs) are nothing new. They have been around for decades in one form or another. Some have even become ‘new conglomerates’ by default with sprawling corporate empires that embrace a wide range of companies with minimal synergies. They exist to make money where others have failed.

Their perceived modus operandi is controversial. They chase complacent or under-performing companies for takeover and then transform them via ruthless cost-cutting and cash generation. Assets - maybe the whole company shorn of cost, or profitable bits of it - are then sold on for a profit. It’s a form of corporate ‘invigoration’ that has always attracted some criticism from those who view their approach in terms of ‘asset stripping’ that can wreck companies in pursuit of a quick return. And they keep investment spending in the taken over companies to a bare minimum, critics say.

But PEGs counter that they have become more sophisticated in recent years and can bring a number of advantages to running a company over the traditional publicly listed model. Senior staff now include industrialists (like ex-General Electric’s Jack Welch) rather than just financial engineers, they say. And they have a culture which means they keep a close eye on the way their companies are run, they add, rejecting the notion that they are pure asset strippers, something which they say is not in their interests.

*“It is estimated
that there are
now almost 3,000
PEGs and venture
capitalist firms in
the US alone”*

*“Standard & Poor’s
estimates that
private equity buy-
outs in Europe and
the US surged to
US\$440bn in 2006
from a level of
US\$100bn in 2003”*

The arguments will go on, but PEGs have certainly become bigger in recent years and are involved in increasingly large merger and acquisition (M&A) deals or leveraged buyout transactions, funded through mounting levels of debt.

A typical buyout involves taking private a company which is trading on a public stockmarket. A hostile deal to take a firm over might be financed by debt that is a multiple of eight times a deposit paid by the PEG itself. And the big firms are frequently in competition with each other, bidding prices up further.

Phenomenal growth reignites concerns

Stockmarkets themselves have been propelled higher via hectic M&A activity in recent years. Hardly a week goes by without news of a big PEG deal, or PEG interest in a major public company and the PEGs appear to leave few stones unturned in the search for profitable opportunities. They’re active across the world and in many industrial and retail sectors. Just lately there have been more noises of protest echoing the ‘bad-boy’ image that PEGs had in the 1980s, a public perception shaped by the movie Wall Street and the bestselling book, ‘Barbarians at the Gate’, about the battle by Kohlberg Kravis Roberts (KKR) to buy RJR Nabisco. After the ‘greed is good’ era, the buyout boom faltered in the recessionary times of the early 1990s when cheap credit (like ‘junk bonds’) dried up and regulators cracked down on hostile takeover bids. But PEGs never went away.

It is estimated that there are now almost 3,000 PEGs and venture capitalist firms in the US alone. What’s behind the boom in private equity? City analysts say that there is now plenty of money around looking for a home as result of a lack of good alternatives in times of historically low interest rates; PEGs offer a relatively low-risk and high return on investment. The PEGs also like to point out that

Feature

big corporate scandals (like Enron) that send shockwaves through stockmarkets tend to be in publicly held firms rather than private ones.

De-listing their acquisitions means that PEGs can make controversial management decisions without having to worry about shareholder reactions or the need to publicly release information under stock exchange disclosure rules. Employees tend to be fearful for their jobs and PEGs are usually accountable to small groups of private investors and credit lenders.

In summary, their methods may be controversial but they aim to take unprofitable companies and make them profitable via reduced costs and great focus on assets that have value. Financial institutions and fund managers have flocked to them. PEGs have been able to easily finance buyouts through huge loans; if a corporate asset is priced at a high value PEGs are increasingly the only ones able to raise sufficient cash. The deals have been getting bigger, the portfolios wider and the debts even larger. And the biggest private equity firms are now immensely powerful forces.

But just lately doubts have surfaced. The investors who underwrite the debt for the PEG deals have become nervous. The debt market has got tight and even the Cerberus-Chrysler finance deal has had to be postponed. The investment banks themselves are finding themselves with more debt on their books than they would like. It could be that private equity is nearing a high-water mark and that debt markets will simply not be able to fund as many deals as was thought. But, for now, private equity involvement in the auto industry remains strong.

Supplier industry opportunities for PEGs emerging

The automotive industry looks like naturally fertile ground for PEGs. It is subject to rapid structural change, relatively low returns on investment and a wide range of corporate performances; crucially, there are plenty of poor performers out there. In the US supplier industry, an opportunity on a plate seems to have arisen as suppliers have entered Chapter 11. But private equity firms haven't exactly stampeded into the supplier sector. They may be wary that the sector is so troubled that the sell-on price will naturally be depressed.

That may be changing though. Bankrupt Tower Automotive announced earlier this year that it planned to sell most of its assets to Cerberus. Delphi has also attracted private capital from a consortium of PEGs for a US\$2.55bn recapitalisation that it hopes will help it to emerge from Chapter 11 later this year.

However, eyebrows were really raised across the US supplier industry when Carl Icahn's American Real Estate Partners reached an agreement to acquire Lear for US\$5.3bn earlier this year. Lear wasn't even facing Chapter 11, suggesting that Icahn might have seen Lear as a value play. He may have miscalculated though, as

“Why do PEGs think they can succeed where long-established vehicle making groups have failed? One area is the availability of funds and the cost of borrowing”

shareholders who apparently believed that the company was worth more than Icahn's offer eventually rejected the deal.

It would seem that PEGs might be attracted to the US supplier sector on the basis that valuations are indeed very low, but that things can only get better with successfully restructured companies. It remains to be seen how PEG-owned suppliers will interact with their OEM customers, some of whom will naturally be suspicious that they will cut spending in areas like R&D.

PEGs and vehicle assemblers?

Why do PEGs think they can succeed where long-established vehicle making groups have failed? One area is the availability of funds and the cost of borrowing. Chrysler Group's injection of cash from Cerberus will (assuming the postponed deal is eventually done), along with an improved credit rating that reduces the cost of borrowing, help it as it looks to restructure.

In taking Chrysler Group private it can also be argued that the firm will be less encumbered by the need to please investment bank analysts and report to stock exchanges. It can, the argument goes, therefore take a much longer view, an essential part of its turnaround plan.

“We'll be able to run the company the way we want to run it, without worrying about quarterly profit announcements,” maintained Chrysler's CEO Tom LaSorda.

Cerberus can also argue that it takes the long-term health of Chrysler seriously, that its commitment is demonstrated by the auto industry execs on its books - such as ex-DaimlerChrysler and Volkswagen's Wolfgang Bernhard, a man who knows Chrysler well.



David Thursfield, formerly of Ford (the guy who had the run-in with Martin Leach), is there too.

There may also be a sense that Cerberus can open negotiations with the UAW(United Auto Workers) on healthcare, from a position of strength that was unavailable to DaimlerChrysler's management. Everything changes with the change of ownership and the UAW may make concessions in exchange for some assurances on jobs.

Thus far, Cerberus has been cautious in terms of its public statements. It says it plans to stick to the existing turnaround plan. It's a soft and cuddly public projection. And the UAW's Ron Gettelfinger has responded in kind, welcoming Cerberus as the new Chrysler owner in direct contradiction of UAW remarks made when DCX was assessing prospective buyers.

But how does Cerberus make money out of Chrysler and on what sort of timescale? It won't want to hang around for long. Five years might be a kind of extended horizon. Under the recovery plan approved by Zetsche, Chrysler is supposed to be profitable by 2008. If that timetable looks like slipping, or a deal on healthcare with the UAW appears elusive, the hawks at Cerberus might start to carry more weight than the doves. There may be calls to wield the job-cutting axe and think about the value inherent in the firm's three brands - Chrysler, Jeep and Dodge (Jeep being the jewel in the crown).

And Cerberus might feel that a natural market for brands exists in China, where cash-rich firms need credible brands to push ahead with export strategies. If these brands have good distribution networks in place, even better.

Source: just-auto.com's Dave Leggett



Chrysler, Jeep and Dodge are a target of PEG Cerberus



Group Lotus plc

*Head office:
Lotus Cars Ltd
Hethel
Norwich
Norfolk
NR14 8EZ
United Kingdom*

Editor: Peter Morgan

just-auto.com

*Head office:
c/o Aroq Ltd
Seneca House
Buntsford Park Road
Bromsgrove
B60 3DX
United Kingdom*

Contact: Mike Gove

This newsletter was produced for Lotus Engineering by Aroq Ltd. © 2007 All content copyright Group Lotus plc and Aroq Ltd.

