proActive

The official industry newsletter of Lotus Engineering

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March/April 2006

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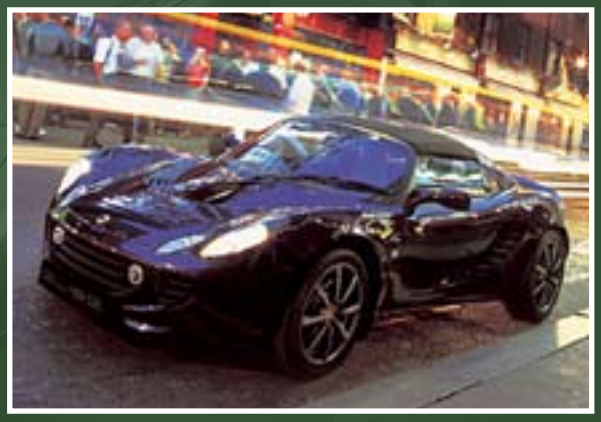

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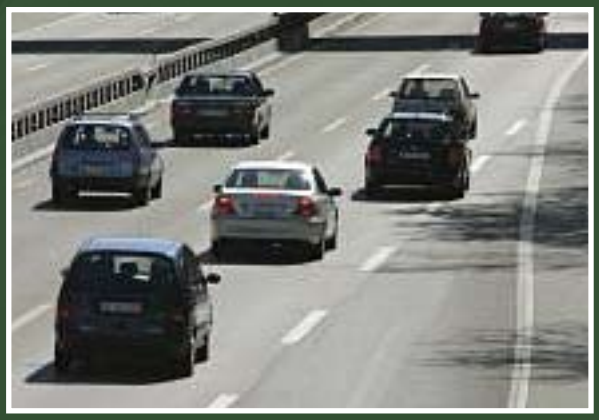


Welcome

Welcome to the thirteenth issue of proActive.

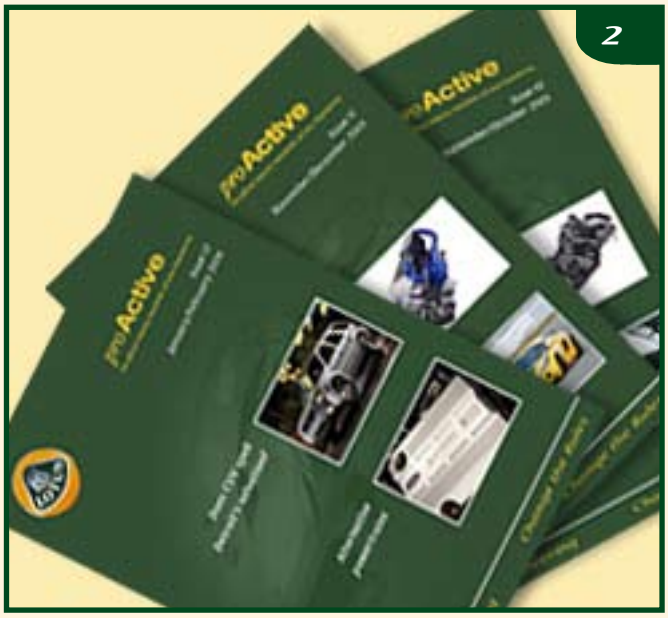
As more people have access to more cars around the world, congestion is inevitable. Building new roads has not proved to solve the problem, and as more people take to their cars, highway authorities are faced with the dilemma of reducing the motoring strain. Car-pooling, an idea tried and tested in the US has now emerged in the UK as a scheme to slow congestion. Chris Wright looks at the latest pilot in the UK; adding a car-pool lane to the M1 London to Birmingham route. We ask whether us British are ready to share our cars? And indeed whether the idea will catch on here.

In addition to our motorway feature we also turn our attention to urban driving. It's often been argued that you can save fuel when driving in your top gear around town. We question this and ask whether you save fuel at the expense of safety. Mark James Lotus' Head of Powertrain and Steve Swift Lotus' Head of Vehicle Engineering share their thoughts.

And finally how could we not mention the Geneva Motorshow 2006. The most important car show in the automotive calendar lived up to its reputation this year and we pick up Dave Leggett's report on just what made it so special.

Enjoy,

Editor, proActive



March/April 2006

news

features

BRAZIL: Fiat will launch tetrafuel vehicle

During a visit by Fiat CEO Luca di Montezemolo to the Betim plant to celebrate 30 years of operation in Brazil, the automaker's Latin American president Cledorvino Belini announced that Fiat will, by the end of the year, launch a 'tetrafuel' version of its locally-made Siena compact sedan.

Encouraged by strong growth in flexible vehicles sales in Brazil, the new vehicle will be an evolution of the normal flex-fuel system and can use four distinct fuels. The Siena tetrafuel will run on Brazilian petrol (with 25% blend of anhydrous alcohol), pure petrol (E0), alcohol or natural gas. The vehicle also runs on a blend of the liquid fuels.

The Siena tetrafuel can also be shipped to other countries to run on pure petrol without engine adjustment.

The fuel system control unit was developed jointly by Fiat and Magneti Marelli.

The supplier said about US$6m was spent developing the tetrafuel system, that adjusts the engine's electronic mapping to work best whatever fuel is being used.

The Siena tetrafuel has one tank for liquid fuels (alcohol and petrol) and a second tank for natural gas, installed in the luggage compartment. Unlike other vehicles running on natural gas, the tetrafuel model switches between liquid and gas fuel automatically.

Consquently, it will start and run on natural gas but, if the control unit determines that it needs more power, such as when overtaking or climbing hills, it will switch automatically to liquid fuel, returning to natural gas when appropriate.

When the gas runs out, the engine switches to liquid fuel.

Until now, only GM has sold a multi-fuel car in Brazil. Its Astra Multipower sedan has a Bosch trifuel system that runs on Brazilian petrol, alcohol or natural gas.

During the first two months of 2006, flex-fuel cars accounted for 74.7% of vehicle sales in Brazil.

The country has a million cars with natural gas systems that work with petrol or alcohol-fuelled engines.

Rogério Louro

UK: Boffin claims satnav distracts drivers

Drivers who take directions from satellite navigation systems could put themselves and other road users at risk, British researchers have claimed.

According to the Daily Telegraph, a study of the reactions of volunteers using a driving simulator showed they were more distracted when given audio and visual instructions than if they had no external instructions to follow.

Dr Mark Wilson, a sports psychologist from Manchester Metropolitan University, reportedly said his findings demonstrated that satellite-based navigation systems distracted drivers and could cause accidents.

"If a pedestrian is crossing at the same time as a driver is concentrating on being given directions it could be enough to take their attention away and cause an accident," he told the annual conference of the British Psychological Society in Cardiff, according to the newspaper.

> *"If you are a solo driver satnav can save you from having to look at a map while you are driving, which in itself can be dangerous"*

An RAC spokesman told the Daily Telegraph: *"If you are a solo driver satnav can save you from having to look at a map while you are driving, which in itself can be dangerous.*

"It gives the driver more time to concentrate on what he or she should be doing."

The report said about 250,000 satellite systems were sold in the UK in the last quarter of 2005.

Another recent report criticised the systems, which have become more popular in the UK since relatively cheap aftermarket models became available, for routing drivers down narrow lanes not designed for large volumes of traffic.

Source: just-auto.com editorial team

UK: New car sales off 1.6% in March

New car registrations in Britain fell 1.6% year-on-year in March, the Society of Motor Manufacturers and Traders told Reuters, although private car sales rose for the first time in two years.

SMMT reportedly said registrations fell to 435,847 units in March and were down 4.6% in the year to date.

However, sales of cars to individuals rose 0.2% to 222,542 units – the first increase in two years – while sales to business customers slipped 18.5% to 30,292 units.

"The lure of the new '06 registration plate and some excellent deals on the forecourts has seen new car buyers heading back to dealerships," said SMMT chief executive Christopher Macgowan, according to Reuters.

"The lure of the new '06 registration plate and some excellent deals on the forecourts has seen new car buyers heading back to dealerships"

"However, a reasonable March cannot mask the poor start to the year, and 2006 will continue to be a challenge for the industry as we fight for every sale."

SMMT predicts that registrations for 2006 will fall 2.7% on the year to 2.375m units - a much smaller decline than the 5% fall recorded for 2005, Reuters noted.

Source: just-auto.com editorial team

US: Hybrid drivers accused of congesting carpool lanes

Los Angeles car poolers have accused owners of hybrid vehicles such as the Toyota Prius of driving too slowly in order to maximise fuel efficiency, and of clogging 'diamond lanes' that were once clear, according to the Los Angeles Times.

Hybrid motorists even have a term for the ill will: "Prius backlash", the paper noted.

"There's a mentality out there that we're a bunch of liberal hippies or we're trying to make some statement on the environment," Travis Ruff, a real estate agent from Newbury Park who drives a Toyota Prius, told the LA Times, adding: *"People are a lot less friendly than when I drove a Mercedes."*

The paper said highway authority Caltrans, which has issued carpool-lane stickers for about 50,000 hybrid cars, plans to study the effect of hybrids on carpool lanes, starting with certain busy freeways (motorways).

"There's not enough excess capacity to absorb the hybrids," James Moore, director of University of Southern California's transportation engineering programme, told the paper. *"I think the foreseeable outcome here is that the congestion advantage we traditionally attribute to [carpool] lanes will disappear."*

The report said a debate over carpool-lane congestion also is occurring in the state of Virginia, which like California allows solo hybrid drivers to use the lanes. Last month, the Virginia Legislature placed curbs on hybrid drivers using the lanes in peak hours, requiring three or more people per vehicle, with a few exceptions.

The Los Angeles Times said the California Legislature approved the hybrids in carpool lanes as a way of encouraging the use of the low-emission, high-fuel-economy vehicles. The law grants carpool-lane access to hybrids that get at least 45 mpg. So far, only the Toyota Prius, Honda Civic and Honda Insight qualify.

From the beginning, the law has prompted complaints from carpoolers, the paper said, and, in recent months the criticism has grown louder as carpoolers accuse hybrid drivers of clogging the lanes, also known as high-occupancy vehicle lanes.

Assemblywoman Fran Pavley, who proposed the hybrid carpool-lane bill, told the paper most hybrid users tell her they love the privilege. Still, she acknowledged that on some freeways, the time saved during rush hour has been a question — something the state study will seek to sort out, the Los Angeles Times added.

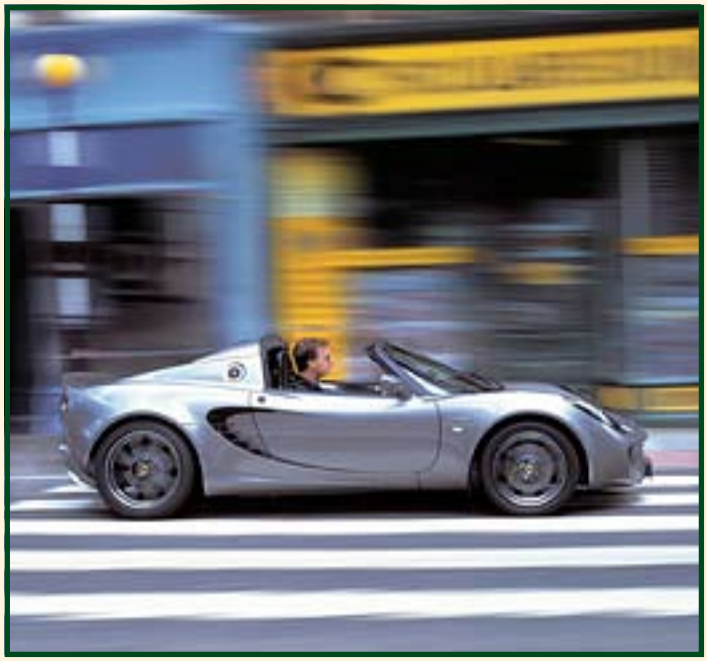
Source: just-auto.com editorial team

Using top gear in 30mph zones: Will it save fuel & is it safe?

Have you ever wondered just what gear you ought to be driving in? Following on from the recent environmental discussions regarding vehicle fuel efficiency proActive asks Mark James, Lotus' Head of Powertrain, and Steve Swift, Lotus' Head of Vehicle Engineering whether the higher gears really are best for driving around town.

So Mark, is it true? Do we really save fuel in 5th/6th gear?

As head of powertrain I am often asked about fuel efficiency and of course, how we can save fuel when driving. When a car is travelling at constant speed it requires the same amount of power no matter which gear is used. Typically 4 to 5 kW is required to travel at 30mph in a typical small family saloon such as a VW Golf or Ford Focus. In 5th/6th (top) gear the engine will be turning at a slower speed than in 4th gear and the throttle will have to be more open to get the same power. (The more open the throttle the less work is required to draw air into the engine so less fuel is used.) Since the engine speed is lower the friction will be less, which will also improve the fuel consumption. Travelling at a steady 30mph, for a typical 1.6L C-class size vehicle using top gear will save 12% compared to 4th and 30% compared to 3rd gear. So, in essence yes, you can save fuel this way.



When a car is travelling at a constant speed it requires the same amount of power no matter which gear is used

In practice however, the engine load is continuously changing to maintain one's position in traffic, even when it is free flowing at a constant and average speed. If a small increase and decrease in engine power is required, the engine controller is programmed to maintain a constant air to fuel ratio to maximise catalyst efficiency and minimise harmful emissions. Therefore, during light acceleration, using top gear will result in a fuel saving.

If a large change in speed is required, the air to fuel ratio will be allowed to change to release full torque from the engine. It is more likely that full torque will be required if top gear is used rather than 4th because the vehicle will accelerate more slowly. Under these conditions it is possible that 4th gear would be more fuel-efficient than 5th/6th, but the difference would be negligible.

First we must stress that gear selection has no material influence on the car's ability to stop in an emergency from low speed

That's interesting, but it's been argued in the past that top gear just isn't safe for town driving, are we putting ourselves at risk Steve?

First we must stress that gear selection has no material influence on the car's ability to stop in an emergency from low speed. But driving safety is about more than this.

Roadcraft, the Police Drivers' Manual, states that the car should always be in the *"correct gear"* which it goes on to define as the gear that gives the right balance of safety and economy. Safety is inextricably linked to control, so there are a number of factors to consider:

You get reduced engine braking in 5th (or top) gear. Therefore you have to use brakes more for deceleration *"check braking"*. However, if the car is doing 1500-2000rpm and the driver had to decelerate, the engine would start to stall which would force you to change gear anyway (or ride the clutch!)

All engines, especially those with high levels of torque, run at a higher idle speed when moving – typically 1200rpm (rather that 800rpm when stationary) equating out for most cars to about 20-25mph and sometimes up to 30mph. This can cause run-away with no control from the driver – therefore essentially freewheeling.

Running in too high a gear reduces the car's ability to accelerate clear of a danger zone.

Lower rpms provided by the higher gears give lower engine noise. Therefore in high gear the driver often feels that he or she is going slower than they really are.

If, by selecting a high gear, the driver reduces his awareness of speed or his ability to adjust his speed both up and down to suit changing road conditions, then we could argue that he is not in control and therefore that he is *"unsafe"*. In this case it would certainly cause the driver to fail an advanced driving test.

Ultimately the decision must lie with the driver. If he judges the level of acceleration available to be acceptable for the road conditions and he has the necessary control of his car then using 5th gear at low speed can be considered to be safe.

With AVT, the engine could even go as far as shutting down a pair of cylinders, reducing the engine size and therefore cutting emissions dramatically

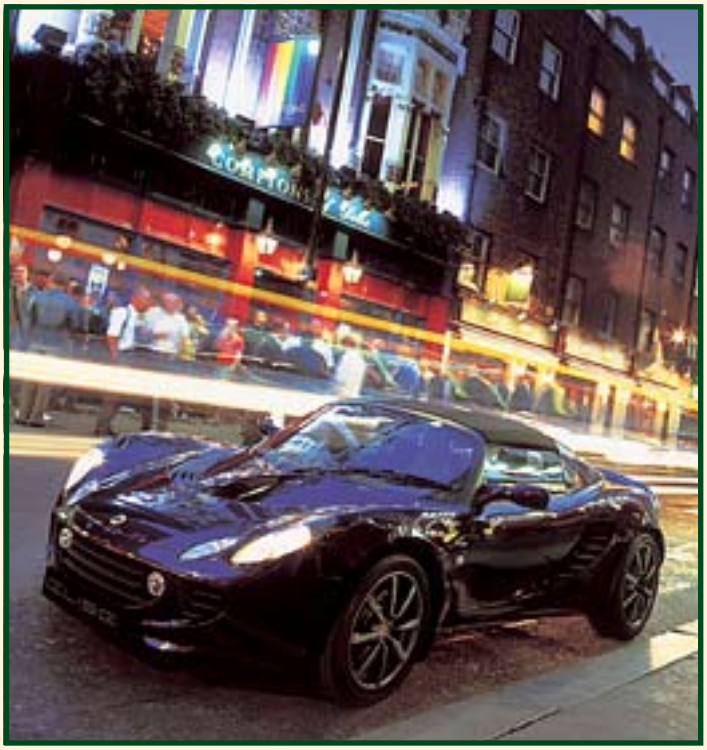
As always, Lotus can provide solutions to the conflict of high gears with regard to safety, emissions and driveability:

Reduced Mass

Lightweight vehicles, such as all Lotus cars, mean that there is less mass to accelerate and decelerate therefore putting less load on the engine and the brakes respectively when driving under normal town conditions.

Active Valvetrain – AVT

Lotus' high end technology that is being engineered for production now gives the engine an infinitely variable number of cam-profiles for the engine, essentially extending the operating range of the engine to give an optimum balance for emissions and power for the engine in that instantaneous driving condition. With AVT, the engine could even go as far as shutting down a pair of cylinders, reducing the engine size and therefore cutting emissions dramatically.



Theoretically you save fuel by driving in top gear around town but it's the variables of traffic flow and conjestion which determine the real saving

Active Noise Control

From Lotus' pioneering work on Anti-noise Cancellation, Lotus has developed a system to electronically cancel out undesirable noise from the engine, tyres, wind and road as well as enhance certain desirable sounds, the throaty roar of an induction or a burble of an exhaust for example. Lotus can alter the sound signature of a vehicle. This would make, in theory, a four-cylinder family saloon sound like a highly tuned V12 engine. This sound would be transmitted into the passenger compartment of the car but not externally keeping the vehicle well within noise regulations. The application possibilities are endless even making a small low revving diesel city car sound like a high revving sportscar!

So there you have it. Town driving in top gear will save you fuel but variables such as traffic flow and congestion mean that actually on a busy day you wouldn't be saving much fuel at all and with an increased number of vehicles on the road, this must be an imperative consideration. Lotus is very conscious of these issues and whilst cannot account for traffic flow is nevertheless committed to making advances in its vehicles to help tackle immediate environmental issues such as fuel efficiency by (amongst other things) making the car lighter. Safety wise, the control of the car is ultimately down to the driver, are you driving safely? We find this a hugely interesting topic and throw open the debate, what do you think? Let us know by emailing proActive@lotuscars.co.uk

Source: Lotus Engineering

GENEVA REVIEW: Niches offer volume gain hope in tight market

Many of the cars on show at the opening of the Geneva Motor Show were as seductive as ever. Glitz and optimism were not exactly in short supply and the choreographed presentations to show the industry's latest products were the usual slick affairs. There will be winners and losers of course, but there were a number of pointers to different growth strategies – in a tight market – for different companies, writes just-auto editor Dave Leggett.

Any observer of the auto industry's global industrial landscape knows that the industry has long been troubled by low margins and overcapacity, though company performances vary widely. For example, among the volume producers, Ford and GM are currently being pummelled financially by their US operations; Toyota is king of organic and long-term sales and profits growth; Hyundai-Kia is positioning itself to follow in Toyota's footsteps; Volkswagen has cost and brand overlap issues; PSA relies on collaborative strategies (and Fiat is now adopting that approach too); DaimlerChrysler needs to fix Mercedes-Benz, sort out Smart; and Renault enjoys more than a little help from Nissan.

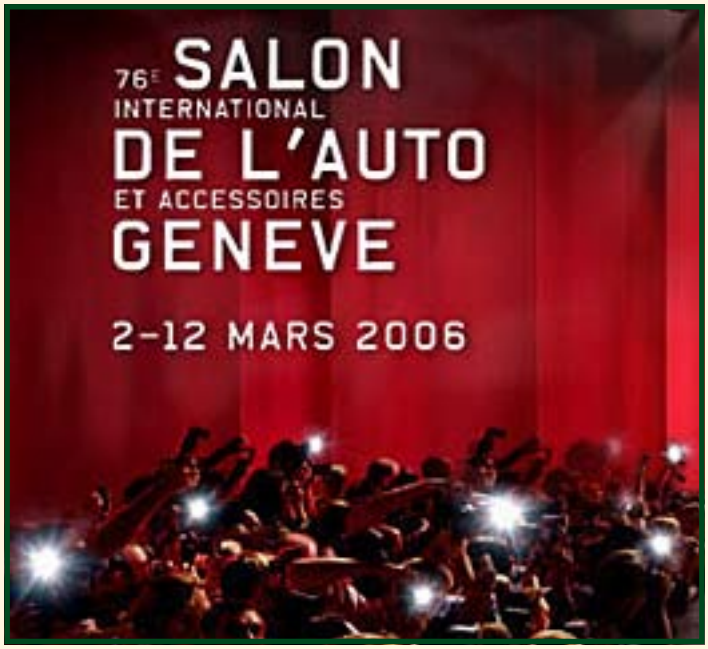
Global footprint with respect to emerging markets with big sales potential may be a key determinant of long-term prospects through both demand and low-cost manufacturing strategies, but no manufacturer can afford to ignore the large bread and butter volume business that is closer to home.

In Europe, competition is tough and margins are low. In Western Europe, car ownership levels are high. Market growth is therefore closely related to the economic cycle and lately that has not been too supportive (although there are signs of some upturn in consumer confidence in Germany early this year). Further east, lower levels of car ownership suggest good potential for market growth, but joining the EU has sucked in vast quantities of used cars and depressed new car market growth. Further east still, Russia offers some quick bucks now while energy prices are high, but investing in Russia comes with big uncertainties on returns.

In short, Europe is not the most hospitable of environments for carmakers at the moment.

Ford Europe goes for niches

If you have the necessary industrial infrastructure to develop them cheaply, niche models offer one route to achieve higher and more profitable volume in a tight market. Ford launched two niche models in Geneva – the S-Max sporty MPV and the Focus Coupe Cabriolet.



The 76th annual Geneva Motor show

The S-Max sits somewhere between the Mondeo and the Galaxy MPV (S-Max is on the new *'CD'* platform) and will be built in Genk, Belgium, on a 'flexible manufacturing line' alongside the Galaxy and, eventually, the next Mondeo.

S-Max embodies Ford's new design direction, dubbed *'kinetic'* (*'energy in motion'* according to Ford) and its sporty credentials are underlined by the fact that it will include a variant fitted with the 5-cylinder turbocharged 220 horsepower engine used in the Focus ST.

To further emphasise the S-Max's sporty proposition Stephen Odell (VP Marketing Sales and Service, Ford of Europe) stressed Ford marketing initiatives such as the sponsorship (until 2009) of the UEFA football (soccer to Americans) Champions League.

"Linking ourselves with this great competition we are able to reach out and communicate with our target customer groups in a really exciting way," he claimed.

Will it succeed in the market and win back lost sales for Ford in the D-Segment? Opel/Vauxhall tried something similar with the Signum (different approach, but same aim) and that failed. The concern for Ford must be that a more affluent and aspirational 'Mondeo man' has gradually upgraded to premium brands over the last ten years. A sporty MPV with the blue oval on the grille may not, therefore, be enough to bring him back into the fold. More generally, there might be another concern that Ford, in covering all the MPV bases, risks confusing the MPV customer. How much differentiation will the consumer perceive between the S-Max and the Galaxy (or possibly even the C-Max – S-Max is available in five- and seven-seat configurations)?

Are there enough customers out there to justify Ford's approach? We'll see.

The danger with producing models for smaller sub-segments is that the market volume ultimately does not justify the investment.

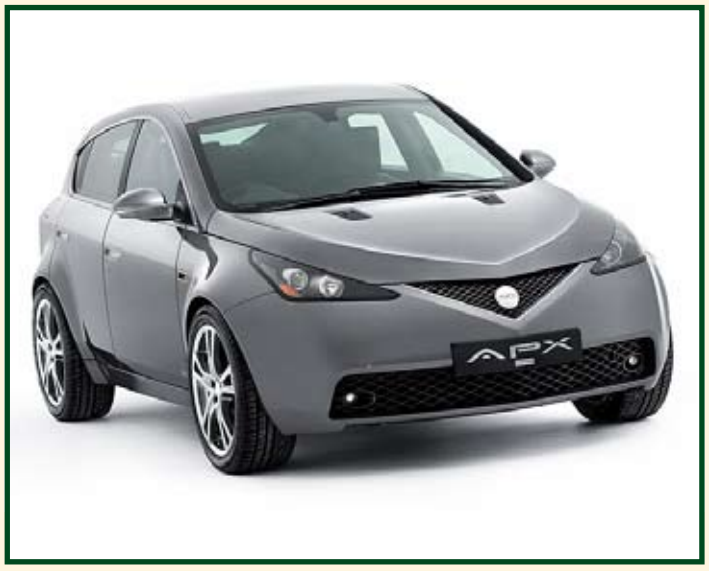
Niche model development 'off the shelf'

If sub-segments and niche models are the thing, then the next question must be how to develop such products cheaply. Partnerships are one way to go. Working niche models off generic platforms works well for those makers with available platforms for the purpose. Flexible manufacturing techniques have also helped, bringing the breakeven point of production down and making lower volume niche production more viable. But that is not always the best route. Sometimes the appropriate vehicle architecture is not available at the right cost. Buying in that architecture could be an option.

In Geneva, Lotus Engineering displayed its APX (Aluminium Performance Crossover) concept based on its Versatile Vehicle Architecture (VVA) approach. APX is a four-wheel drive crossover fitted with a supercharged 3-litre engine with 5+2 seating layout. Lotus claims that the concept is a *'feasible prototype close to production'* and that the APX could be taken away for modification with a view to production in a short period of time.

The VVA approach is designed to meet a gap in the market for the vehicle manufacturer looking to develop a sports-based niche car product. The idea is that it sits in between the two options of either, i) the large cost of developing a new platform, or, ii) working the vehicle off a mainstream platform but incurring design and/or performance compromises. The philosophy is based on the commonality and versatility of key elements in the vehicle structure so that a *'family'* of niche vehicles can be developed. Use of aluminium keeps weight down.

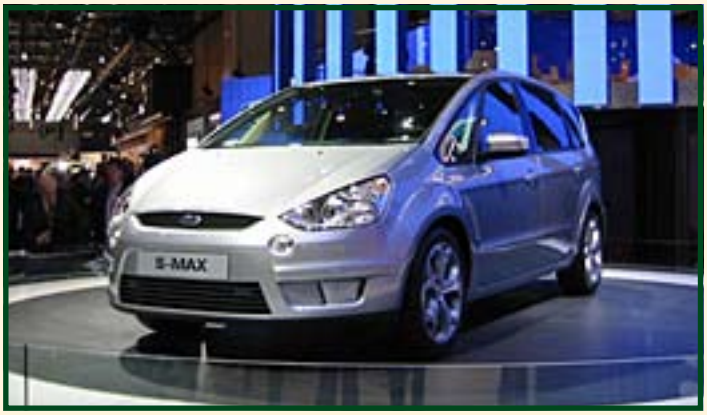
"A vehicle maker looking for a range of niche products might be a suitable candidate for this," said Lotus General Manager, Marketing, Rob Tickner, *"and the APX shows how easily it can be done."*



Lotus' APX

Retain and grow to higher margin products

Another strategy for success in a tight market is to move into higher margin territory – basically make bigger and more upscale vehicles with a bigger price tag and profit margin (the main fixed costs incurred in making and selling cars do not differ that much between the small car and the big car – we're talking same basic components that have to be put together). Renault, for example, sees itself growing operating margin as it gravitates towards higher margin products over the next few years. The tricky bit is doing that on the Renault brand, though an analyst I spoke to reckoned that Carlos Ghosn's strategy isn't quite as ambitious as it sounds when you compare Renault margins with those of PSA and look very closely at the incremental volume gains that Mr Ghosn is talking about.



Ford's S-Max

Still on Ford, Lewis Booth (chairman of Ford of Europe with responsibilities for PAG also) stressed the importance of the PAG brands to Ford. He was speaking the day after he had told an investors' conference that Ford is fully committed to Jaguar, contrary to rumours that it may have been up for sale – to Renault, actually – at the end of last year. There were no press conferences at Geneva for Jaguar as there was no new product.

But there was a Land Rover press conference that majored heavily on future technology which will make Land Rovers more environment friendly. It's a multiple tiered approach, embracing, for example, bio-diesel (5% bio-diesel mix for Land Rover diesel engines now, rising to 25% eventually) and a belt-driven Integrated Starter Alternator running with an electric rear-axle drive.

The apparent fragmentation of the European car market into yet smaller sub-segments has been made possible by better and more flexible manufacturing processes and techniques. If, as a vehicle manufacturer, you have your manufacturing infrastructure sorted out (including good relationships with key suppliers), know your market and have a product that sits solidly inside a brand that embodies the right values, your new niche model may well

Car-sharing: an idea whose time has come on this side of the Atlantic?

Congestion. It's the scourge of the motorist, and as motorisation increases around the world, taking to the open road will become less of an option. Sitting in a slow-moving convoy may come to be seen as the norm.

Building more roads has not proved to be an answer in developed countries and now highways authorities are looking to make better use of existing road capacity in order to ease congestion.

To do this they need to reduce the number of vehicles using the roads and a number of ideas have entered the mix: one-way streets, bus and taxi lanes, congestion charging, toll roads and car-sharing lanes.

The UK has tried almost all of these, congestion charging in the centre of London and a toll road alternative for the M6 motorway between Birmingham and Leeds being the latest.

Now the British government is planning a High Occupancy Vehicle (or car-sharing or car-pool) lane for its oldest motorway, the M1 between London and Birmingham.

Currently there are only two High Occupancy Vehicle (HOV) lanes in operation in the UK. One is in Leeds and the other west of Bristol. Both are on local roads.

The thing is, will HOVs work and ease congestion on Britain's notoriously crowded roads?

The government claims that reserving lanes for cars carrying at least two people will slow the rate of growth in traffic congestion, which is forecast to rise by up to a fifth by 2010. Work has already begun on a fourth lane in each direction on one of the busiest stretches of the M1, which is used by more than 160,000 vehicles a day. Once the widening is completed in December 2008, the ten-mile section will have a car-pool lane during peak hours.

The UK's transport secretary, Alistair Darling, has travelled on several car-pool lanes in the United States. He said: *"Car-pool lanes have an important role to play in making best use of road space, as well as helping the environment and reducing congestion. They work in the US and there is no reason they can't work [in the UK]."*

But the Royal Automobile Club (RAC) Foundation for Motoring has flagged up a study by the University of California, Berkeley, which found that car-pool lanes in San Francisco were underused and resulted in longer average journey times.

Up to 2,200 vehicles an hour can travel at 70mph along a motorway lane without encountering any delay. The study found that car pool lanes carried only 1,600 vehicles an hour. Vehicles in car-pool lanes were forced to travel at the pace of the slowest driver because there was too much traffic in the other lanes for them to overtake.

Speed in all lanes rose sharply when the car-pool lanes were opened to all vehicles at 7pm. The study concluded, *"The likely net result of high-occupancy vehicle restrictions (car-pool lanes) in the Bay area is worsening congestion."* The RAC Foundation has previously stated that car-pool lanes could work only if people had a good chance of finding someone making a similar journey.

The Foundation was quoted in an article in The Times saying that motorway drivers had a very broad range of starting points and destinations and there was little chance of being able to share a vehicle without serious inconvenience. If the M1 experiment adds to congestion due to the under-utilisation experienced in the US, then the car-pool lane should become a regular motorway lane.

High occupancy land for UK's M1 motorway

A UK Highways Agency spokesman said that it had yet to decide how the M1 car-pool lane would be enforced and at what times it would operate. *"We plan to use the pilot to develop our expertise in managing car-sharing lanes on the strategic road network,"* he added.

However, in the United States many HOV lanes are now being changed into HOT lanes or High Occupancy Toll lanes. These are freeway lanes restricted to a combination of high-occupancy vehicles and others willing to pay a toll. There are already four in operation in California and Texas, and twelve others at the planning stage.

A further development is HOT networks where existing HOV lanes are converted to a form of super-HOT lane, using the toll revenues to pay for missing links and interchanges to create a seamless network of limited access lanes. Eight areas of Los Angeles, San Francisco, Washington DC, Seattle, Houston, Dallas, Atlanta and Miami are considering HOT networks.

Edmund King, executive director of the RAC Foundation said: *"The advantage of the HOT lane is that value pricing – American*

PR-speak for road pricing – can moderate demand. Using lane management, authorities can promote car sharing, truck access, buses, or low emission vehicles. Lanes can be reversible to reduce peak congestion and new income is generated. There are environmental benefits as there is less stop/start traffic. More importantly the Americans are finding that HOTs improve the efficiency of HOV facilities."

But do HOT lanes just become 'Lexus Lanes' utilised by the more affluent motorists? HOT data shows users in all income brackets use and support HOT lanes. King added that 25% of motorists on the San Diego toll lane are in the top income bracket, but the majority are low- and middle-income motorists. A majority are willing to pay to avoid congestion with no statistical correlation evident between income levels and ability to pay.

There is always a way to buck the system making enforcement problematic. Stories from the United States are legion. In California in the 1980s many drivers used Ronald Reagan blow-up dolls as passengers while enterprising UCLA students hired themselves out to drivers.

In-lane cameras do not work because it is difficult to verify the number of occupants especially if there are small children in the car. Tinted windows are also a problem, so in the US there is a visible and consistent police presence near tolling points or HOV lanes.

Hefty fines work as a deterrent. In California the penalty rises to US$1,000 after the third offence although King said the reduction in the numbers of traffic police in the UK did not bode well for enforcement.

He added: *"The lesson from America is that car pools only work when linking dense residential areas with central business districts. They can be formed in areas where many people live and also commute to the same districts. The incentive has to be a reduced journey time (and cost) by using the HOV. HOT lanes work best on busy motorways close to Metropolitan areas."*

While giving a cautious welcome to the idea of HOV lanes, the RAC Foundation said that these should only be considered if an additional lane is to be constructed, and if the HOV lane is under-utilised, it should be opened up to all traffic.

Pollution is another bi-product of traffic congestion and while many HOV schemes in the United States also allow them to be used by low-emission vehicles, there are no such plans for the UK currently.

The UK's biggest push to relieve congestion in recent years has been the introduction of a congestion charge to the roads in central London. All vehicles are photographed as they enter the zone and are faced with a GBP40 (US$70/EUR57) fine if the charge of GBP8 is not paid by midnight.

King said: *"In central London the charge has reduced congestion and improved the environment but central London is unique. 86% of commuters used public transport prior to congestion charging and London has an extensive public transport system. Other cities would need massive investments in public transport, park and ride etc before a feasible scheme could be introduced."*

Source: Chris Wright, Interchange

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