

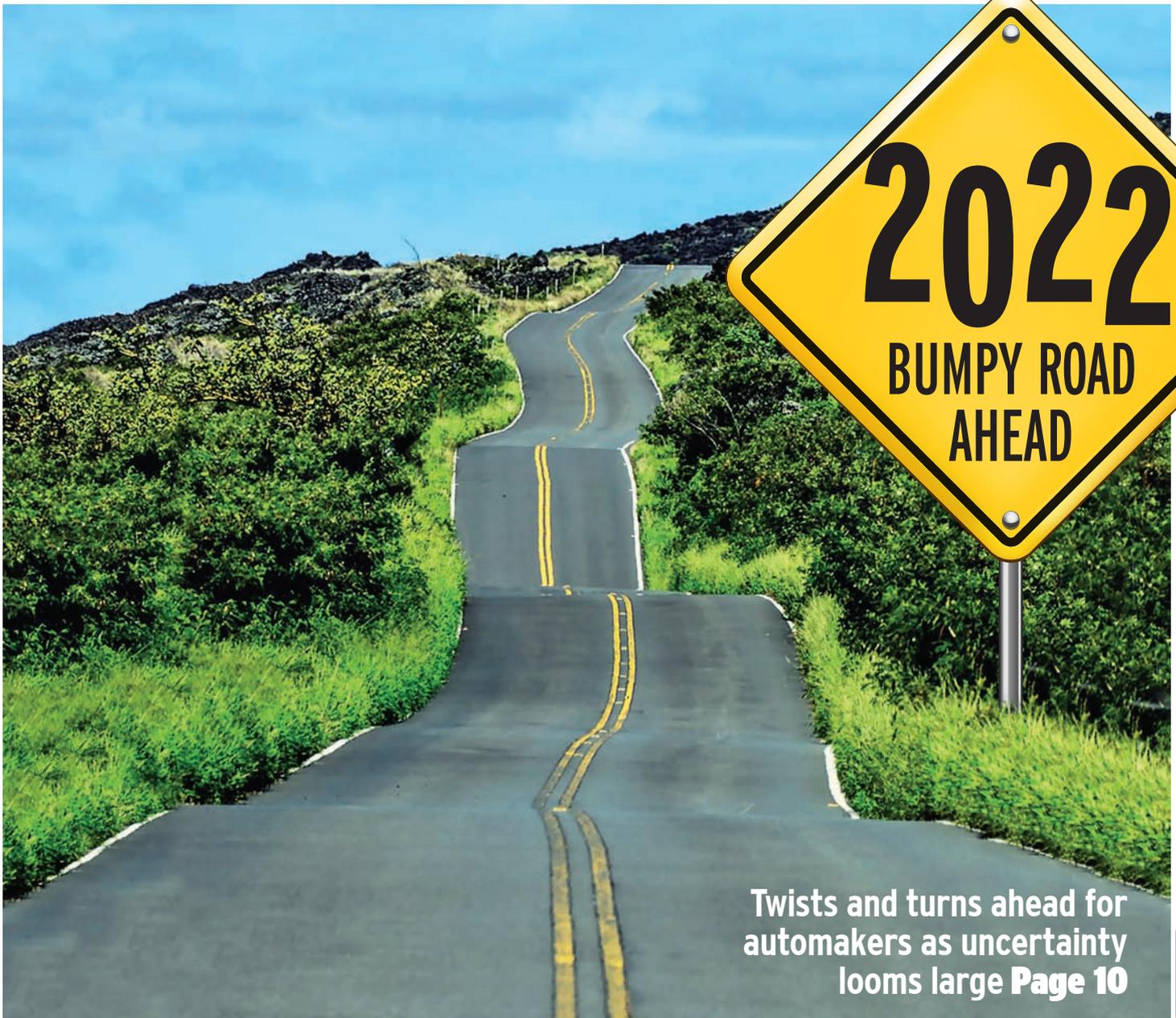
professional

Essential reading for the Automotive industry

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Twists and turns ahead for automakers as uncertainty looms large **Page 10**

haymarket

LIGHTWEIGHTING

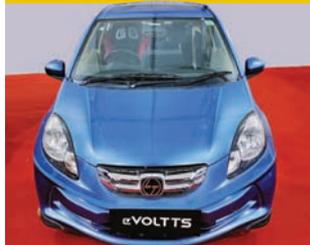


Weight loss as top priority

Autocar Professional's virtual conference draws the who's who of industry

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ELECTRIC MOBILITY



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How telematics is enabling real-time monitoring of CV fleets and reducing operational costs **Page 20**

Collaboration, cost and convi

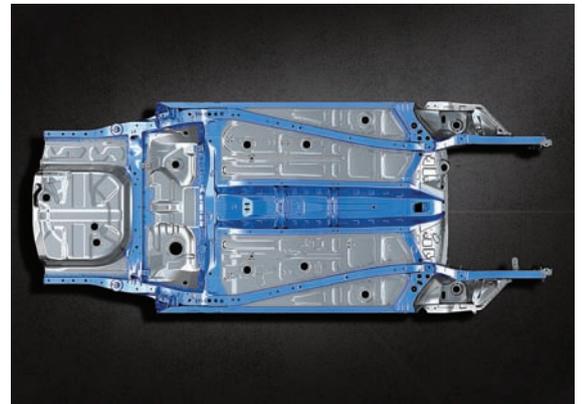
As OEMs and component manufacturers stretch the vehicle lightweighting envelope to maximise gains about the need for a heightened level of partnership. **Sricharan R** reports on *Autocar Professional's*



Range matters, whether it is a car, a train, a plane or even a spaceship. Getting to your destination with ease and efficiently at that, whatever the fuel in use, is the mileage mantra for mobility engineers. Which is why, in a world which is fast running out of fossil fuels, is hugely impacted by climate change and is aggressively looking at newer ways of enhancing sustainability, the megatrend of vehicle lightweighting has assumed heavy proportions in the automotive scheme of things.

Lightweighting is akin to weight-loss therapy which is designed to improved overall health, in this case vehicle efficiency aka range. Reducing vehicle weight impacts a vehicle in multiple ways – by reducing engine, braking and rolling resistance (tyre) losses directly and indirectly by enabling a smaller but more efficient engine / powertrain to

Maruti Suzuki's Heartect platform, which uses advanced and high-tensile steels, also reduces the load on engine, chassis and suspension and other components to offer enhanced fuel efficiency as well as reduced emissions.



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ction to drive lightweighting

from cutting-edge technologies and new advanced materials, captains of industry are unanimous recent webinar on the topic and how it is changing operational dynamics across the auto world.



Whatever the choice of fuel, reduced vehicle weight is the overriding mantra for OEMs to achieve enhanced efficiency.

deliver the same or better performance than a bigger, more powerful but energy-sapping sibling. And lightweighting assumes even greater significance amid the global shift towards electrified vehicles be they BEVs or PHEVs. Cutting kilos off body weight and shaving grams off key components all serve the single-point focus reducing the amount of 'juice' required to be drawn from the EV battery.

Suffice it to say, automakers' focus to reduce vehicle weight has a direct connect with their market performance. In a time when petrol costs Rs 000 a litre, diesel Rs 00 and CNG Rs 63.50 a kg, vehicle buyers across segments – cars, two-wheelers and commercial vehicles – are willing to

C V RAMAN: '360DEG APPROACH NEEDED'

WHEN IT COMES to fuel efficiency, passenger vehicle market leader Maruti Suzuki is at the top. In fact, out of India's top 10 most-efficient petrol cars, eight are Marutis. Clearly, the company knows a thing or two about lightweighting.

Chief Technology Officer C V Raman, in his keynote address at the webinar, said: "The regulatory situations in India are changing. Going forward, we will soon see CAFE norms, BS VI Phase 2 and many more. And lightweighting plays a pivotal role in reducing emissions."

Referring to climatic changes, he mentioned that the transport sector in India contributes to 13 percent of greenhouse gas emissions. Though these are lower than GHG emissions by auto in the EU, PVs in India contribute to 40-45 percent of this, of which two-wheelers account for 40-45 percent and CVs the remainder.

"A 10 percent weight reduction can improve fuel efficiency by 3-4 percent, and reduce emissions by 3-4 grams. This will push everyone in the chain to push lightweighting," he said.

He added, "When you look at the per capita income of India, it is lower when compared to China. We have a passenger vehicle penetration of 13 per 1,000 and have 13 million two-wheelers. These challenges are unique to India. But, one thing which is clear is reducing emissions."

Raman highlighted the benefits of using

CV Raman: "A ground-up platform needs to be built for lightweight EVs." We need to have a 360-degree approach.

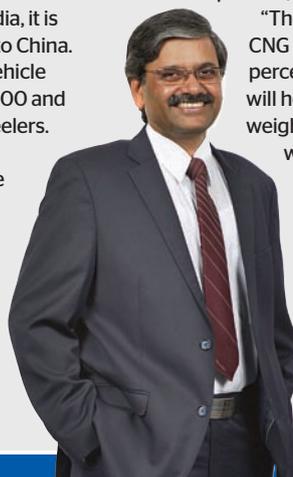
advanced high-strength steel (AHSS) and Suzuki Motor's Heartect platform, which helps improve structural and torsional rigidity, increases strength but also reduces weight and in turn emissions. Thanks to this, the current Swift is 125kg lighter than the first-gen model of 2005. "Maruti Suzuki is switching over to the fifth-gen Heartect platform," he said.

Raman believes lightweighting can also be addressed by a combination of optimum materials and manufacturing technology and called for a collaborative effort from industry.

"There is also a need to build a collaborative ecosystem. Recycle, reduce and reuse will be the way forward. Also, we need to continuously upskill the workforce," he said.

Citing examples, Raman mentioned that conversion of metal fuel tanks into plastic have reduced weight by 30 percent and obviated rust-related issues. This also enabled easier packaging. "Even in powertrain, there has been a significant increase of plastics and castings, reducing weight by 30 percent and cost by 47 percent," the Maruti CTO said.

"There is much potential to reduce CNG cylinder weight by 50-60 percent by using composites. This will help reduce overall vehicle weight and increase efficiency. This will also enable use of hydrogen-CNG mix. In EVs, battery weight is a challenge. We need to look at the battery platform, explore substituting materials and use advanced high tensile steel. A ground-up platform needs to be built for lightweight EVs. We need to have a 360-degree approach," he highlighted.



"Lightweighting plays a pivotal role in reducing emissions. A 10% reduction will reduce emissions by 3-4% and will push everyone in the chain to push lightweighting."

CV Raman - Chief Technology Officer, Maruti Suzuki India



Ashok Leyland's Dr N Saravanan: "OEMs need to collaborate more on lightweighting initiatives. There's a gap in skill level in simulation and material understanding and industry needs a holistic approach to reduce emission across the manufacturing cycle."



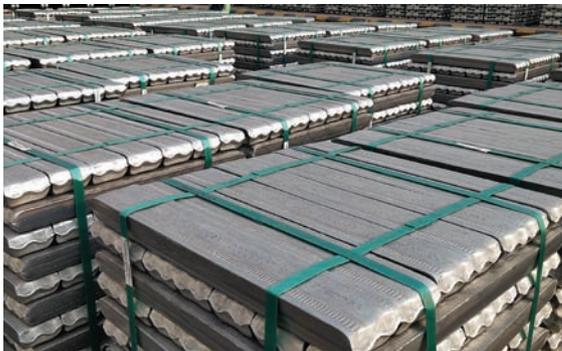
spend on vehicles that offer lower cost of ownership which is possible when they get more mileage for their money.

Thus, just when November was turning into December, *Autocar Professional* hosted the last of its 10 webinars held in CY2021 on the topical theme of 'Emerging Trends in Automotive Lightweighting' over the last two days of the second-last month of the year.

New-gen materials management

Day one of the online conference was on the overall theme on 'New-Gen Materials for Lightweighting'. Opening the two-day event was **CV Raman, Chief Technology Officer, Maruti Suzuki India** who delivered the keynote address (see panel box on page 25). The panel discussion soon after included Dr N Saravanan, Chief Technology Officer, Ashok Leyland; Barun Bharadwaj, Director – Automotive OEMs, Henkel Adhesive Technologies – India, Middle East & Africa; Nikhil Bhagchandani, Deputy Director, Aluminium Marketing, Vedanta and Pandu Ranga Rao, SVP, Tech Operations & Strategic Initiatives, Altair India.

Dr N Saravanan, Chief Technology Officer, Ashok Leyland



kicked off the discussion reiterating the importance of collaboration in the current context. He said, "OEMs need to collaborate more for lightweighting initiatives. There's a gap in skill level in simulation and material understanding with respect to lightweighting. We need a holistic approach to reduce emission across the manufacturing cycle."

He also mentioned that small volume production (from niche segments) is a new trend in the automotive industry, while mass volume products continue to see sustained demand for vehicle lightweighting. Saravanan explained that there are higher lightweighting penetration levels in BEVs, which can offer greater opportunities for industry to experiment with. In contrast, conventional fuel vehicles such as those running on diesels witness a lower adoption considering that total cost of operations (TCO) remains an important parameter for CV fleet operators.

Barun Bharadwaj, Director – Automotive OEMs, Henkel Adhesive Technologies – India, Middle East & Africa pointed out the importance of creating a strong business case for all stakeholders across the value chain to enable a circular economy in the context of material lightweighting. "As more and more new materials come into play, there are many challenges for OEMs keen on lightweighting. Improvement on cost performance is crucial and the decarbonisation of the automotive value chain is important," he said.

Seconding that view, **Nikhil Bhagchandani, Deputy Director, Aluminium Marketing, Vedanta** said, "The adoption of lightweighting tech is moving at a rapid pace in India, particularly driven by emission regulations. In cars, average lightweighting currently stands at 4-5 percent versus 14-15 percent in developed markets, which offers huge scope for India's automotive industry."

Bhagchandani also believes that significant cost reduction of materials can happen only when key alloys are produced locally. Vedanta, one of the largest aluminium

Vedanta's Nikhil Bhagchandani: "Adoption of lightweighting technologies is moving at a rapid pace in India, particularly driven by emission regulations. In cars, it is 4-5% versus 14-15% in developed markets, which offers huge scope."

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"Lightweighting is now a key topic in the industry and as we make a transition to EVs, it becomes key in terms of getting range and efficiency. It is a relevant topic for designers and it's important how a vehicle is depicted visually."

Martin Uhlarik - Global Design Head, Tata Motors



manufacturers in India and a key supplier to the automotive industry, believes a lot of investments are required to bring material traceability into the ecosystem.

"Lightweighting has evolved across the years. Aluminium and composite materials have helped in increasing the efficiency, and also from the safety perspective. More than 90% of aluminium goes into the circular economy," he added.

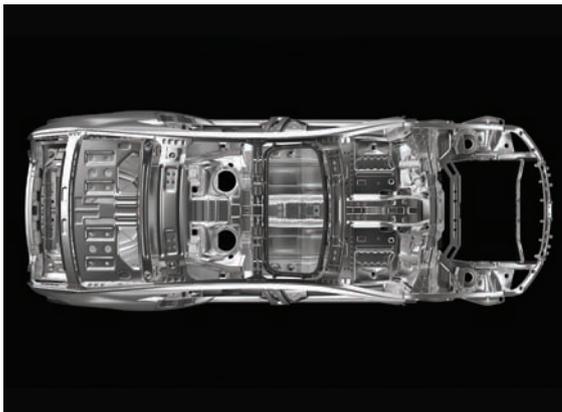
Bringing designing perspective to the discussion, **Pandu Ranga Rao, SVP, Tech Operations & Strategic Initiatives, Altair India** emphasised that simulation offers plenty of flexibility at the concept stage and with OEMs increasingly not looking at carryover design, the digital twins are enabling realistic product options. "Simulation is not just plug-and-play. There is plenty of calibration. Material suppliers and the ancillary industry are doing great work. A lot of work is being done collaboratively across India Auto Inc," remarked Rao.

Adopting innovation

Day 2 opened with a power-packed panel comprising **Martin Uhlarik, Global Design Head, Tata Motors**; **Santhosh K Jacob, Director and Country Manager, Igus India** and **Sanjeev Ghosh, Senior Technical Specialist, Autodesk India** who came together to voice their views on 'Innovative Solutions for Lower Vehicle Weight' in a panel moderated by **Hormazd Sorabjee, Editor, Autocar India**.

Highlighting the importance of vehicle safety while implementing lightweighting concepts, **Martin Uhlarik, Global Design Head, Tata Motors** pointed out that, "Safety is an absolute pillar for TataMotors. You cannot design a vehicle that's any less than a five-star vehicle. We explore lightweighting options - it's a balancing act meeting various needs with safety."

Uhlarik explained how the designers need to be more creative while building vehicles for a highly price-sensitive market like India. Refuting popular notions about the weight of the vehicle and its safety, Uhlarik pointed out that the "segment and typology of a vehicle decides its weight. The body size needs to communicate strength depending on the



Most industry experts believe that the vehicle design needs to maintain a fine balance between attributes and lightness. They should not be overburdened with mass. The nimble aspect is key.

MAHINDRA'S R VELUSAMY: 'Innovations can reduce vehicle weight'



Mahindra's XUV700 got a GNCAP 5-star safety rating, four stars for child occupant function.

LIGHTWEIGHTING PLAYS A critical role right from the design aspect of a car. According to R Velusamy, Chief of Global Product Development, Mahindra & Mahindra, to achieve a five-star crash rating, there needs to be a reduction in weight. He said that around 110kg of the new XUV700, which was recently awarded a five-star Global NCAP rating, was saved due to design and use of high tensile steel and advanced plastics. The tailgate was one of the areas where the team could reduce around 15-20kg.

In a one-on-one conversation with *Autocar India's* Hormazd Sorabjee, he said, "Once you decide to achieve five-star safety, there is no option but to reduce vehicle weight. One needs a lot of focus on BIW mass (which is going to crash at 65kph). You can use hot formed steels at different parts of the vehicle. In the XUV700, plastics were used in the inner portion of the tailgate. A combination of lightweighting and a clean manufacturing process helped in reducing the weight."

The Indian auto industry is now actively using aluminium to reduce vehicle weight albeit this increases cost. According to Velusamy, the doors, fenders, bonnet and suspension can be considered to use alternate materials. He mentioned that advanced high tensile steel, ultra-high tensile steel and boron steel can be used.

"Aluminium blocks improve manufacturing and 30-35kg can be

reduced. There are some key areas for lightweighting including powertrain and Body In White (using advanced high-strength steels instead of mild steels)," he added.

"Criterion for selecting areas where weight can be reduced in a vehicle include dynamics, optimisation of suspension, and reducing the BIW mass. More than technology, it has become the cost aspect. We try to work with aluminium forgings but the design has to allow that. The cross-bar beam and steering wheel are candidates for use of magnesium. Plastics can do wonders for areas like the fender and tailgate," highlighted Velusamy.

Commenting on EVs, he said there will be an increase in weight and there is a necessity to find new materials. "In EV reinforcement, this will play a major role," he added.

On a concluding note, he said that four reasons will increase net vehicle weight. "Customers need quality products and design will undergo change due to their need for improved NVH levels, ride and handling, top-notch safety and technology features. Industry needs to be innovative to reduce vehicle weight."

R Velusamy: "Once you decide to achieve five-star safety, there is no option but to reduce vehicle weight."



"As regards new materials for lightweighting, the crossbar beam and steering wheels are candidates for use of magnesium. Plastics can do wonders for areas like the fender and tailgate."

R Velusamy - Chief of Global Product Development, Mahindra & Mahindra





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Henkel Adhesive Technologies' Barun Bharadwaj: "There will be rapid development in lightweighting technology in India. We see early engagement and thought process in incorporating sustainable lightweighting materials. This is the need of the future – for entire society and the environment."

segment. There is a fine balance between vehicle attributes and lightness. They should not be overburdened with mass. Communicating a nimble aspect is important."

Offering an insight into the working of current trends, he added that currently designers are working from the ground up and, from the design point of view, EVs are going to offer a lot of opportunities. "I see the full-electric generation of cars as a very exciting one for designers." Tata Motors has had a strong showing in Global NCAP's crash test results in recent years, and now holds six out of the top 10 positions, with three of them being five-star rated cars.

Sanjeev Ghosh, Senior Technical Specialist, Autodesk India said that traditionally simulation tools have been resource hungry. Ghosh claims that Autodesk is working on balancing functional requirements and structural components. "We are looking at identifying the constraints involved in materials used and methodologies. By enabling designers to leverage the power of the Cloud where machine learning helps take the load off them, our simulation suites and solutions allow them to do many things at the same time." He explained that the direct conversion between ICE and EV has largely happened in the auto industry and now the efforts are being made to bring differentiation into design and efficiency of the vehicles.

Offering perspective from the component suppliers' side, **Santhosh Jacob, Director and Country Manager, Iigus India** opined that the car cabin is literally the second home these days for commuters and therefore needs to be a silent zone as far as possible. "There is a growing interest from OEMs in vehicle weight reduction. With sharper focus on EVs,

they are also keen to reduce noise. In terms of reducing the number of components, plastics help OEMs & Tier 1s do that," said Jacob, highlighting that Iigus conducts tests on about 500-800 compound compositions annually. Currently these are extruded and tested in Germany because low volume demand in India presently does not make business sense for producing it locally.

In a one-on-one conversation that followed the panel discussion, **M S Shankar, President & Head, Group Innovation & Technology, Anand Automotive** pointed out that, "It has to be a mindset of sustainability which is the big industry driver. Reducing emissions and greenhouse gases, need to reduce consumption of resources, and partnerships between designer, strategist and materials requirements is needed."

He mentioned that it is all about approaching the issue with a new mindset and said innovation needs to be initiated at the grassroots level, "Addressing sustainability is crucial."

According to him, there are four key aspects – strategic



Santhosh K Jacob, Director and Country Manager, Iigus India: "When you completely change a metal part to plastic, there are moving parts where is where Iigus' expertise comes in. OEMs are aggressively shifting to plastic from metal."

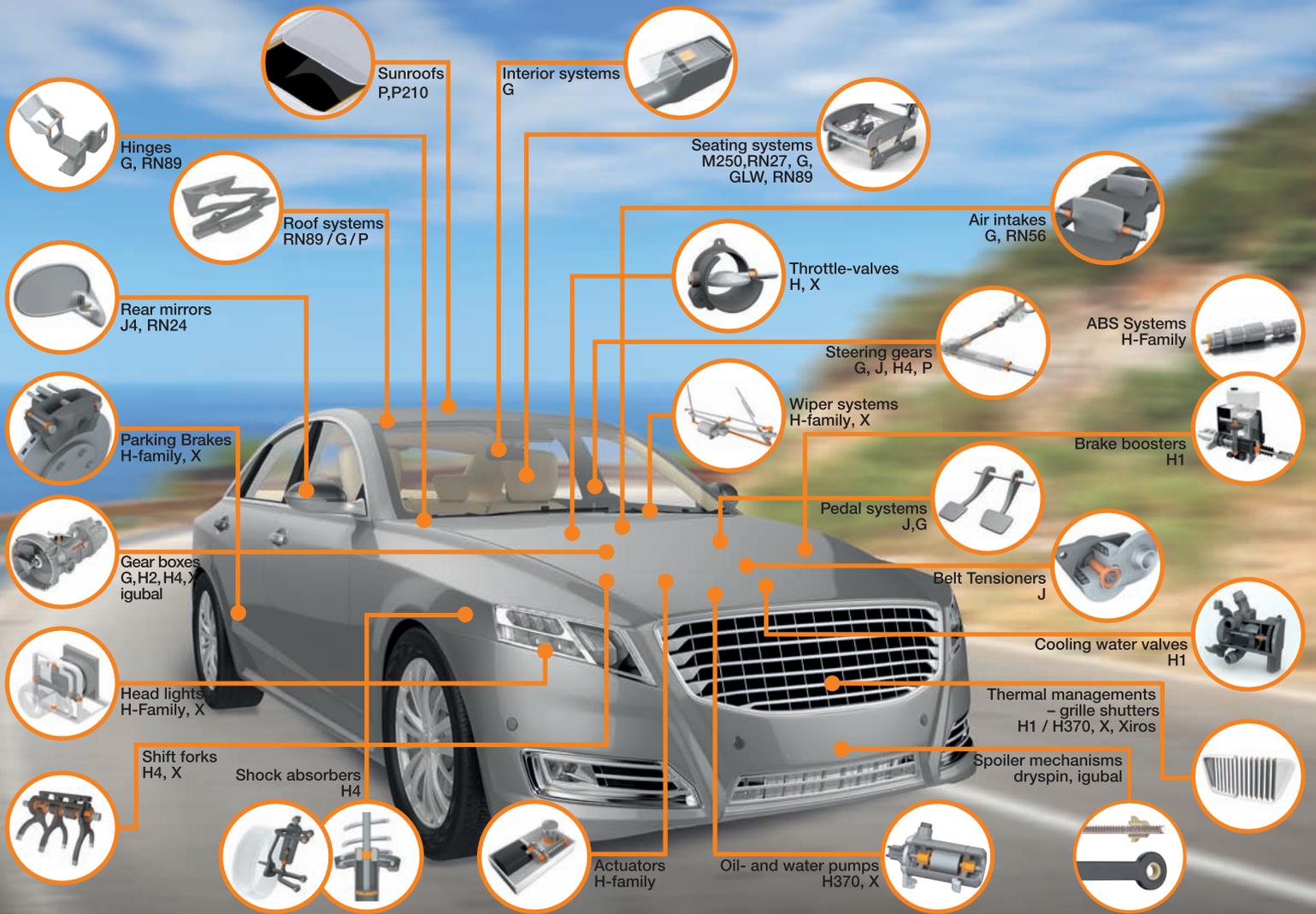


"Small volumes are a new trend. Industry can start looking at 3D printing as an option. As regards high-volume production new platforms (which lasts for 10-15 years) will see more emphasis on Lightweighting. Both approaches will see new materials."

Dr N Saravanan - Chief Technology Officer, Ashok Leyland

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AUTODESK PUSHES THE LIGHTWEIGHTING ENVELOPE

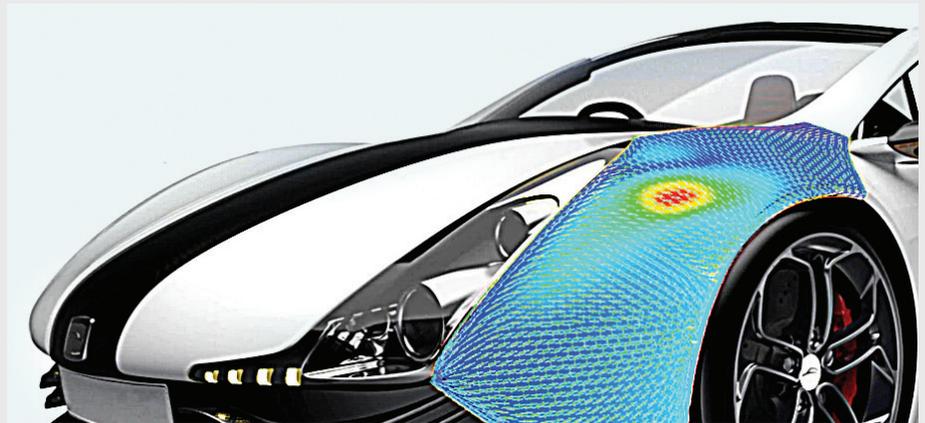
AS INDIA AND governments the world over increasingly mandate stiffer emission norms and vehicle buyers vote for increased fossil fuel economy and EV range, OEMs are pushing the developmental envelope in terms of both using new lightweight materials as well as getting to market faster.

With different options available, automotive lightweighting is emerging as a clear favorite and gives companies like Autodesk, a global leader in design-and-make technology, another industry segment to unlock opportunities with simulation.

While traditional processes of physical prototyping and testing prove expensive and are also time-consuming, simulation enables vehicle manufacturers as well as suppliers to explore varied lightweighting opportunities with multiple materials. OEMs too are making the shift to advanced materials, which react differently compared to conventionally used ones. Autodesk has a suite of products designed to specifically address automotive lightweighting applications. These help:

- Optimise the manufacturing process
- Reduce weight
- Control part strength and stiffness
- Predict performance in practice
- Select the best material for your application
- Discover issues early in the design process

These were among the key takeaways that came from Sanjeev Ghosh, Senior Technical Specialist, Autodesk India. With the overall theme of 'Innovative solutions for lower vehicle weight' holding sway, Ghosh said traditionally simulation tools have been resource hungry. "We are working on balancing functional requirements and structural components. We are also looking at identifying the constraints involved in



Autodesk India's Sanjeev Ghosh: "Our products think of taking manufacturing as a mean to design from the start. The design that comes from our solutions are validated for various manufacturing outcome."

materials used and methodologies."

He added, "By enabling designers to leverage the power of the Cloud where machine learning helps take the load off them, our simulation suites and solutions allow them to do many things at the same time," indicating how simulation is giving automobile designers a free hand in the modern scheme of things, even as they engage far more openly with the engineering component in vehicles.

Citing an example, he said the A-pillar in a car has become thicker over the years as a result of increasingly stringent safety norms. And, it is now moving towards the use of



materials. "Our products think of taking manufacturing as a mean to design from the start. The design that comes from our solutions are validated for various manufacturing outcome," he said.

Commenting on the industry shift towards electrification, Ghosh explained that there has largely been a direct conversion between IC engine vehicles and

electric vehicles but now efforts are underway to differentiate the design and efficiency of the vehicles. "We are able to understand how passengers handle various elements in a car. We have also been able to see how various components fit in a car. This is an evolving area. We are looking at a similar kind of approach as in nature to design structures. We are researching and working towards that."

SRICHARAN R



Anand Automotive's M S Shankar: "We are at a tipping point in EVs. Cost is important to lightweight. It is possible to achieve 10-15% cost reduction by systematically challenging past practices."

thinking with business focus, focus on manufacturing and innovation, addressing sustainability, and chasing aspirational goals. Also, 'the term optimisation is a bad word' to him.

"It should be disruption. One has to come up with a disruptive overall cost management, managing multi-material cost to arrive at a new dynamic for the industry. EVs are no doubt the future. Electric vehicles have been the drivers and they have grown over 6-7 times in the last year. The need of the hour is to focus on manufacturing methods, integration and invention," he said.

Stating that cost is important to lightweight any component in vehicles, Shankar says that investment is a huge challenge here. Also, 'from an Indian perspective, consolidation is not easy, but collaboration is.'

"It is possible to achieve a 10-15 percent reduction by

"Lightweighting is never done at the cost of safety. Instead, the modern approach industry is taking is how can new materials improve vehicle safety."

Nikhil Bhagchandani - Deputy Director, Aluminium Marketing, Vedanta Ltd.





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ALTAIR HELPS OPTIMISE LIGHTWEIGHTING

ALTAIR, THE GLOBAL technology company that provides software and cloud solutions in the areas of product development, HPC, and data analytics, is connected in a big way with the world of automotive lightweighting. In fact, each year, it hosts the Altair Enlighten Awards, the automotive sole award for vehicle lightweighting and sustainability honours latest advancements in cutting carbon footprint, mitigating water and energy consumption and promoting material reuse and recycling.

One of the many simulation tools that help automobile manufacturers achieve their goals of lightweighting is developing digital twins. Digital twins help users optimise product performance, gain visibility into the in-service life of a product, know when and where to perform predictive maintenance, and how to extend a product's remaining useful life. The Altair digital twin integration platform blends physics- and data-driven twins to support optimisation throughout the products lifecycle.

To put it simply, digital twins are a digital window into a component or a vehicle, applying physics and machine learning in real time -- this helps the user gain otherwise inscrutable information into behaviour, and then translate it directly to action. This reduces the cost of operation, avoids production stoppages from catastrophic failures, and extends the working life of individual assets.

The Altair digital twin integration platform essentially is a window which addresses the full complexity of operation: machine learning insights blended with physics simulation to



Altair India's Pandu Ranga Rao: "Concept today takes into account manufacturing flexibility, cost of ownership, cost of running and the serviceability aspect as well."

help find hidden inefficiencies and correct them.

That's just what Pandu Ranga Rao, Senior Vice-President, Tech Operations & Strategic Initiatives, Altair India, highlighted. He emphasised that simulation offers plenty of flexibility at the concept stage and with OEMs increasingly not looking at carryover design, the digital twins are enabling realistic product options.

Rao explained that for lightweighting fuel economy was a driver at one stage. Then factors like performance, power-to-weight ratio and sustainability were considered. "Cost of ownership is also motivating and the



lightweighting. I see a lot of innovation at the concept stage of vehicle lightweighting," he said.

He pointed out that there's plenty of flexibility at the concept stage. The biggest paradigm change is that OEMs are not looking at carryover design. Digital twins are enabling realistic product options, he mentioned. "Concept today takes into account manufacturing flexibility, cost of

ownership, cost of running and the serviceability aspect as well," he added.

One of the major challenges is the cost, he said. But once users recognise the importance of lightweighting, the cost-benefit ratio balances out. In the future, there will be a lot more refreshes, a lot more runners and repeaters of the same product according to him.

SRICHARAN R



Tata Motors' Martin Uhlarik: "Lightweighting is a key topic as it is making a transition to different powertrains. It is a primary issue from the efficiency and from the designing perspective."

systematically challenging the past practices. All we have to do is chase an aspirational goal. It is the intensity of the thinking that helps us to meet the cost," Shankar mentioned.

He signed off saying that in the coming future we will definitely see disruptive change in the way materials are used in the Indian automotive industry compared to the West.

All the speakers at the virtual conference were unanimous in agreeing that balance between safety and efficiency is crucial when it comes to lightweighting. Given the increased awareness and need to reduce the carbon footprint, 'going light' is no longer an option but a necessity. However, effective execution is an absolute necessity to address concerns about both affordability and vehicle safety in this process. The speakers agreed that deep study of various products and methodologies will help the industry offer the right product mix at the most affordable price point. *Autocar Professional* thanks all speakers, attendees and sponsors including Altair, Autodesk, Ansys and Ark Infosolutions. ■

"There will be rapid development in lightweighting technology in India. We see early engagement and thought process in incorporating sustainable lightweighting materials. This is the need of the future – for entire society and the environment."

Barun Bharadwaj - Director – Automotive OEMs, Henkel Adhesive Technologies - India, Middle East & Africa

