

ALUMINIUM TECHNOLOGIES

CONTINUAL DEVELOPMENT FOR AUTOMOTIVE APPLICATIONS (PART 111)

Understanding Mixed Materials □ Aluminium Intensive □

With our ongoing feature on Aluminium - and parts I and II covering attachment methods and other auto maker strategies on aluminium usage technologies - this article will focus on the fundamentals and various examples of "Mixed Material" and "Aluminium Intensive" ideologies.

As the name suggests, mixed materials terminology is used to describe vehicle structures that generally utilize Advanced High Strength Steels (AHSS) in conjunction with mainly, but not exclusively, aluminium materials - other products can often include magnesium and advanced plastics / composites, such as Carbon Fibres, Kevlar, Fibre Reinforced Polymers (FRP) and glass reinforced plastics (GRP).

All of these materials are used in highly variable ratios / percentages, dependent on make, model and ongoing developments. With aluminium, apart from the different types of alloys that make up the composition, there is also the choice of manufacturing processes that are chosen for their distinctly different properties, such as flexibility, rigidity, torsional strength, crash management predictability, as well as cost effectiveness and ease of manufacture etc.

These aluminium structures are described as "Stamped", "Cast" and Extruded. Further to this is the emerging use of "Hydroforming" in aluminium components, which is a variation of the extruded process.

Auto bodies that have body closure panels, such as door skins / shells, boot lids, bonnets and other "bolt on

panels" are typically described as mixed material vehicles - especially so when the main structure or "BODY IN WHITE" is made from traditional or advanced steel materials. Conversely speaking, when the "body in white" is constructed largely of aluminium materials, this is classified as being an "Aluminium Intensive" structure.

On a global perspective, both "Mixed Material" and "Aluminium Intensive" vehicles are the domain of higher end or luxury models and brands. In many instances, these "High End" vehicles are still produced in large numbers that arguably qualify them as "Mass Produced" - and therefore this suggests that these technologies will become more mainstream in the future.

MIXED MATERIAL EXAMPLES:

Globally speaking, perhaps the most widely known, massed produced mixed material vehicle body structure is the Cadillac CT series (USA) - introduced in 2015, this vehicle features 64% aluminium in the vehicle body , including all of the closure panels. High Strength Steels are used strategically in the cabin module, including all of the B pillar area.

Aluminium extrusions, casting and stampings are utilised in abundance over the whole of the body in white. Attachment processes include Aluminium and steel spot welds (STRSW), Self Piercing Rivets (SPR), Flow Drill Screws (FDS), laser welding, Alu arc welding, and extensive use of structural adhesives.



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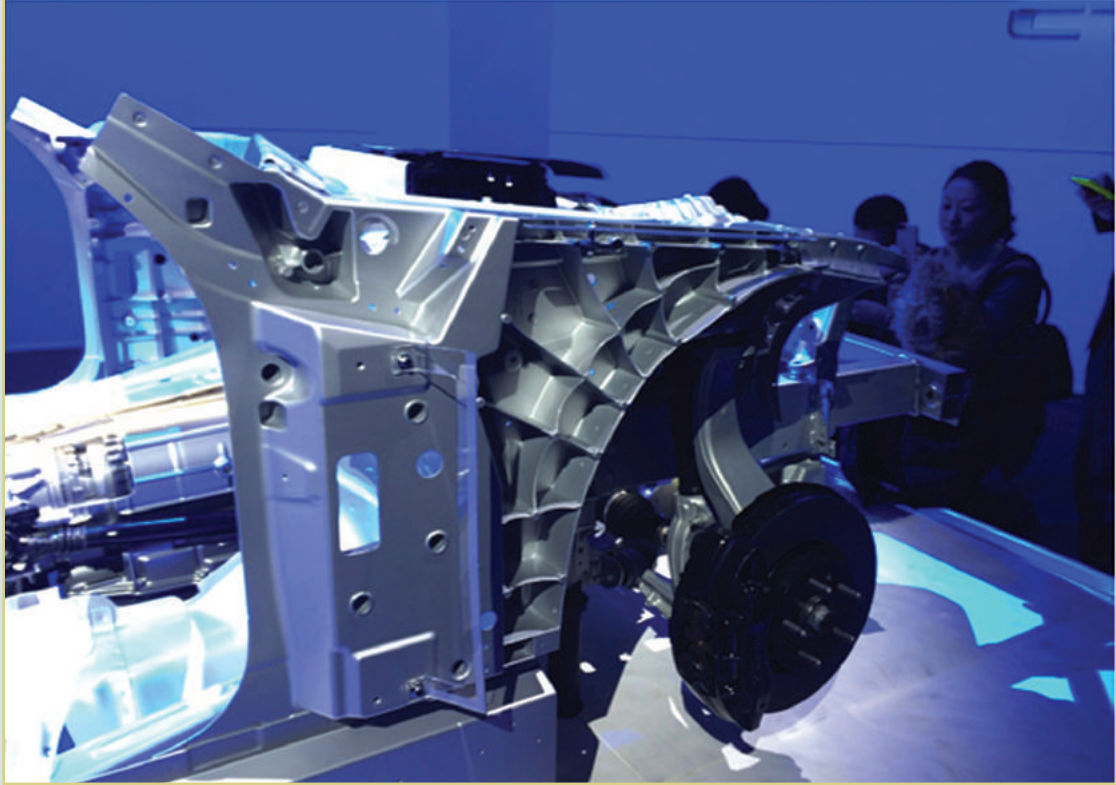
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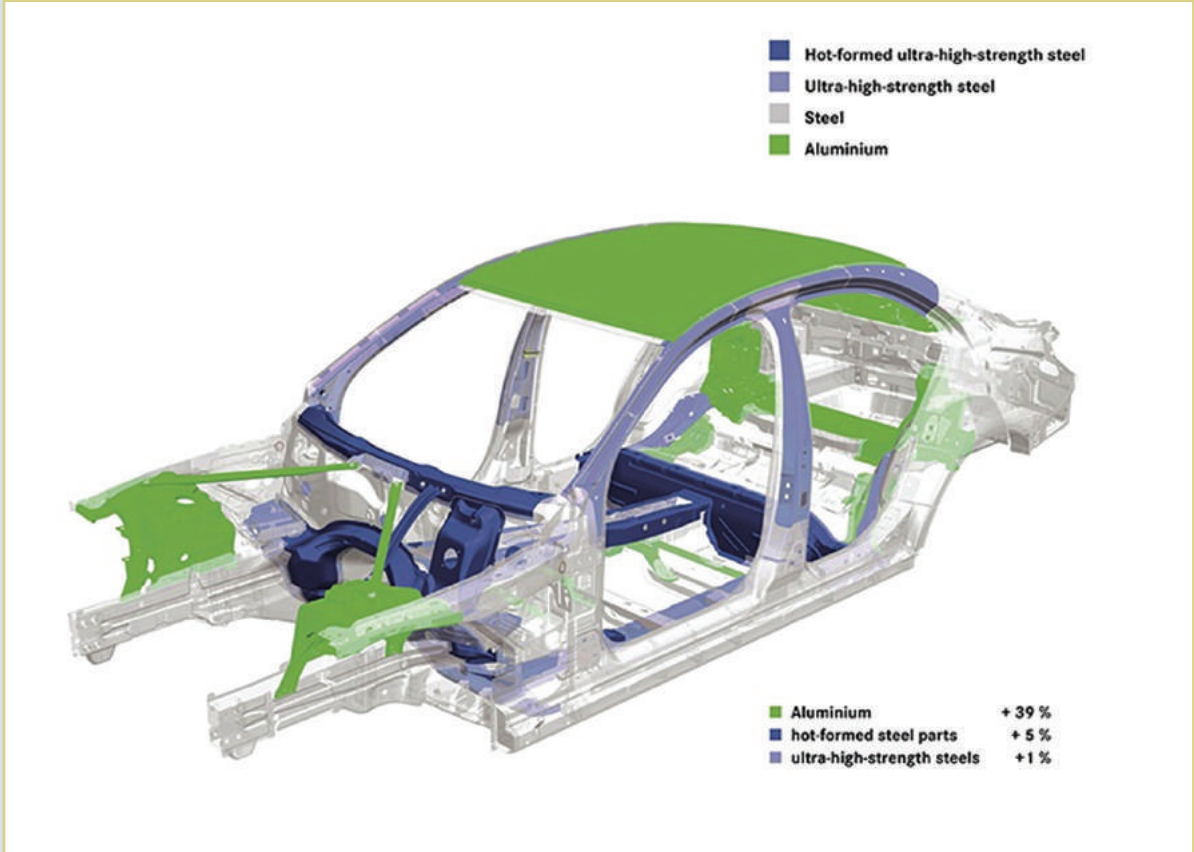


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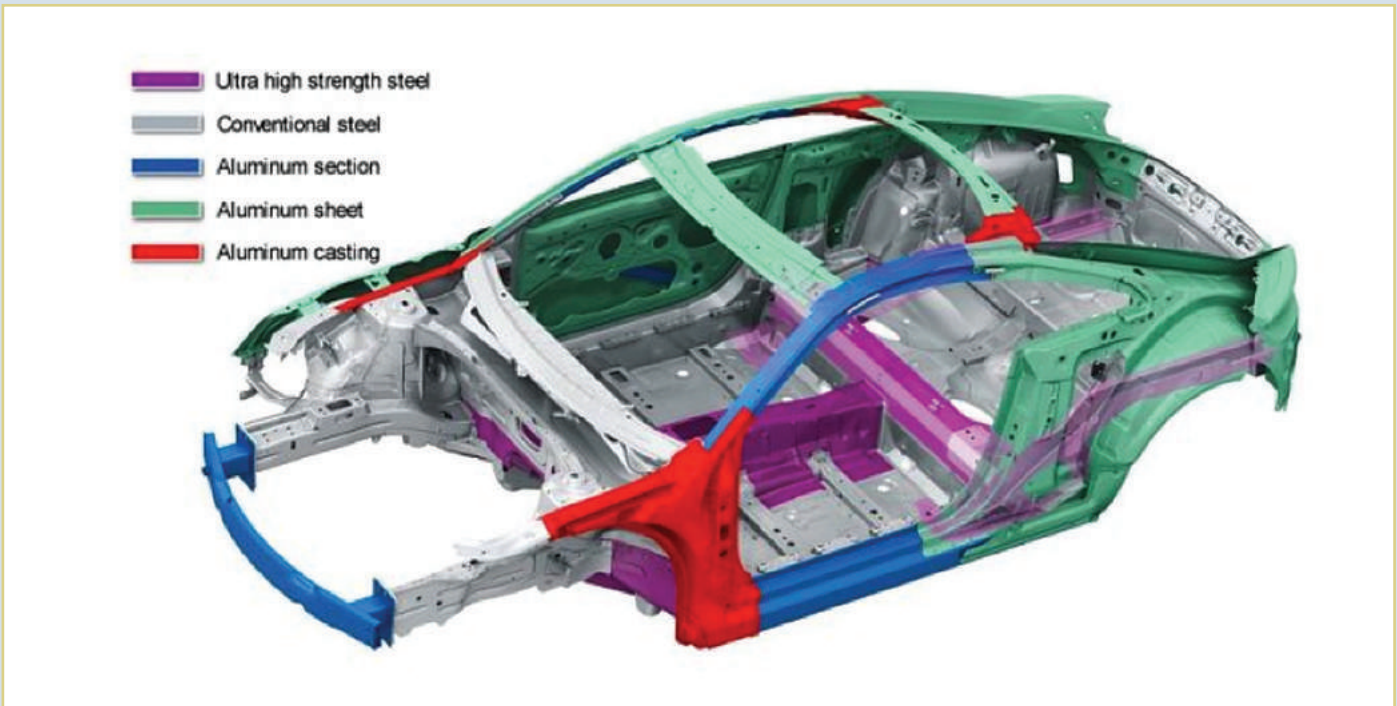


CADILLAC CT

OTHER EXAMPLES:-



MERCEDES LIGHT WEIGHT BODY SHELL

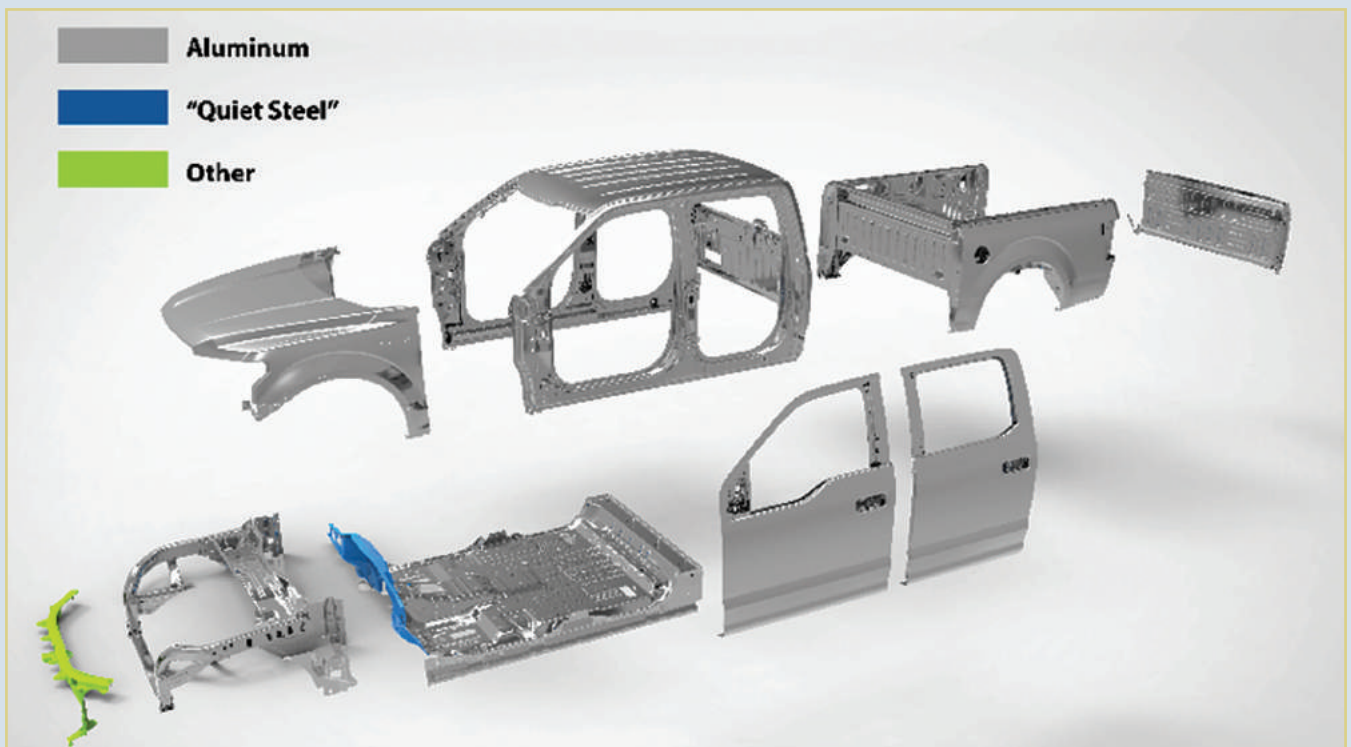


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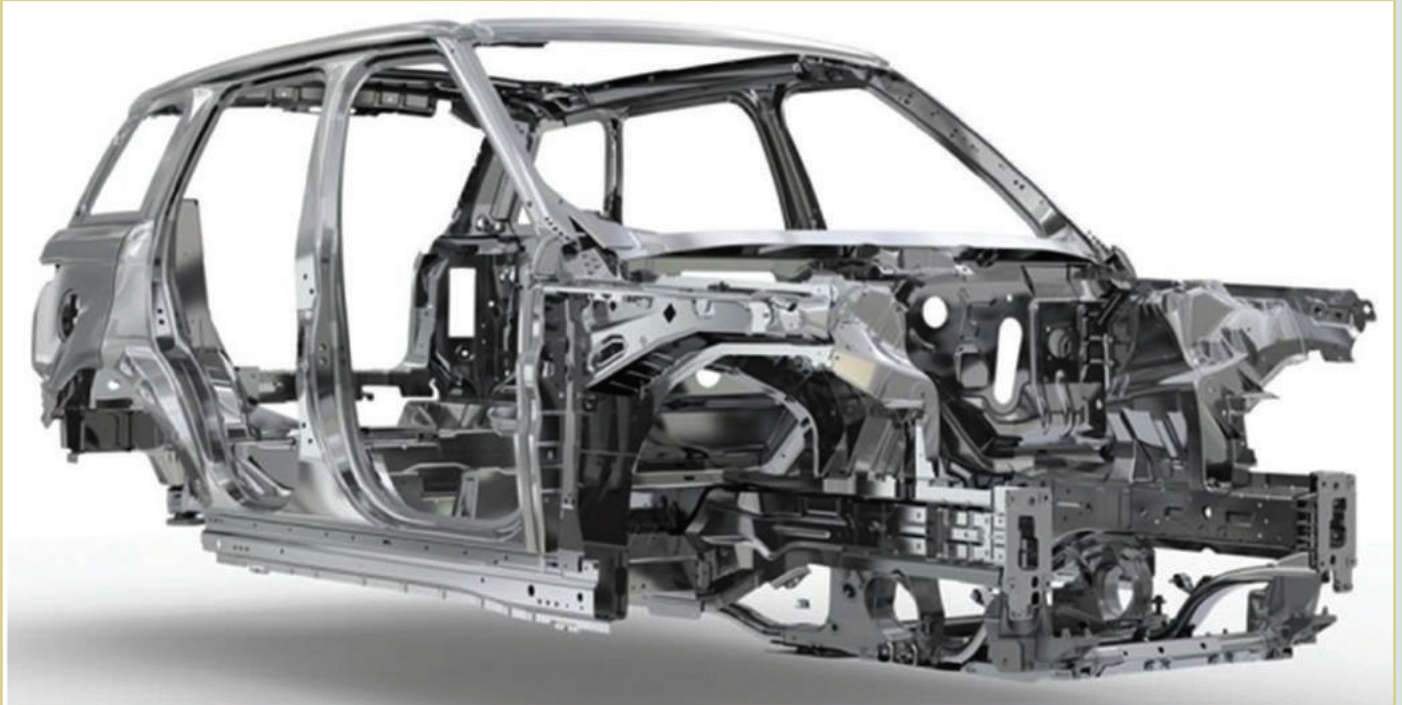
ALUMINIUM INTENSIVE EXAMPLES:



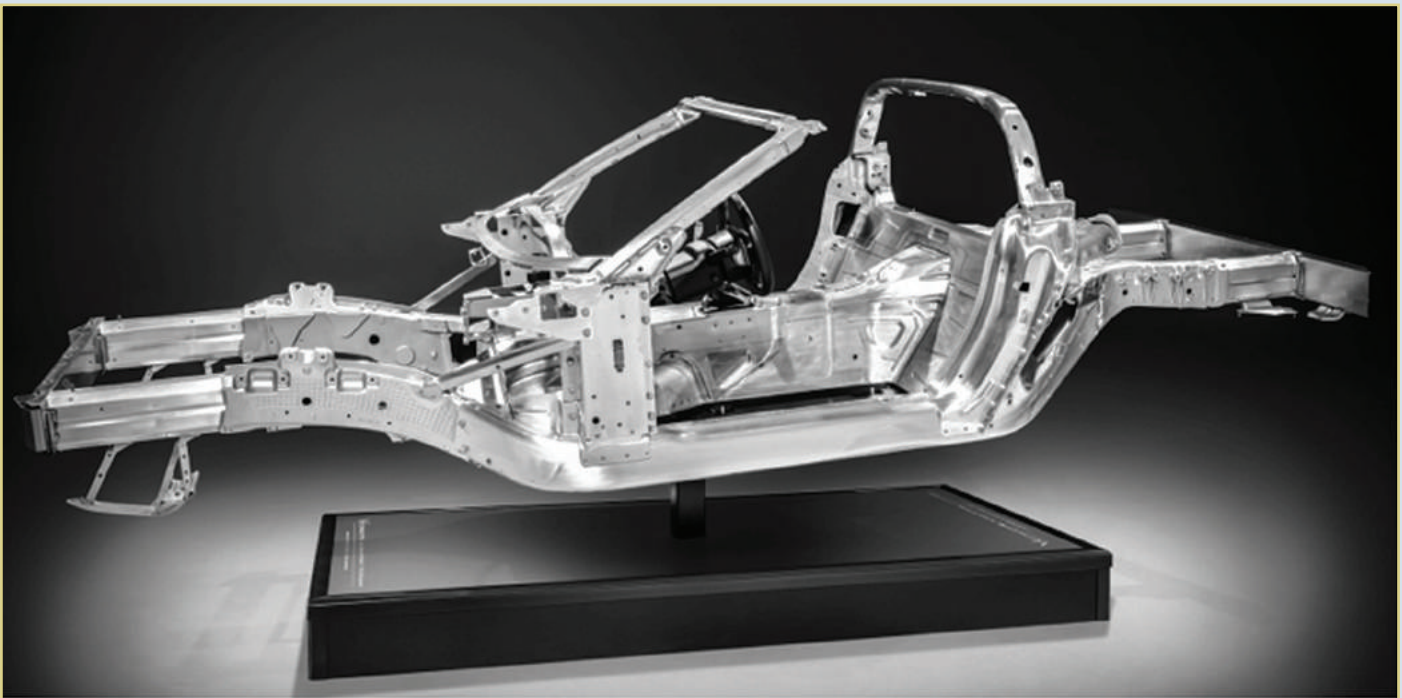
HONDA NSX - for the most part, an aluminium structure, with some HSS (590Mpa) shown in Green and UHSS (1500Mpa) shown in Brown.



FORD F150 - Full upper body is constructed from aluminium, with the exception of the radiator core support (Composite) and the firewall / bulkhead (Laminated Steel for NVH control). The separate full frame chassis is mainly HSS materials.



ALL NEW RANGE ROVER - Full aluminium monocoque body is 39% lighter than the previous generation body - over-frame structure. Up to 75% of the aluminium used is from recycled materials.



2015 CORVETTE - The full Aluminium chassis frame is so strong that no additional reinforcements are required for the convertible model. Alloy STRSW, flow drill screws, laser welding and structural adhesives are used in the assembly processes - the outer body panels are made from lightweight Sheet Moulded Compound (SMC) polymer materials. Dimensional accuracy is claimed to be within 0.75mm, with the aluminium ranging from 2mm to 11mm in gauge thickness, and utilizing cast, extruded and stamped components. The centre torque tube through the tunnel is made from carbon fibre materials.