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Supplying to Mercedes Benz

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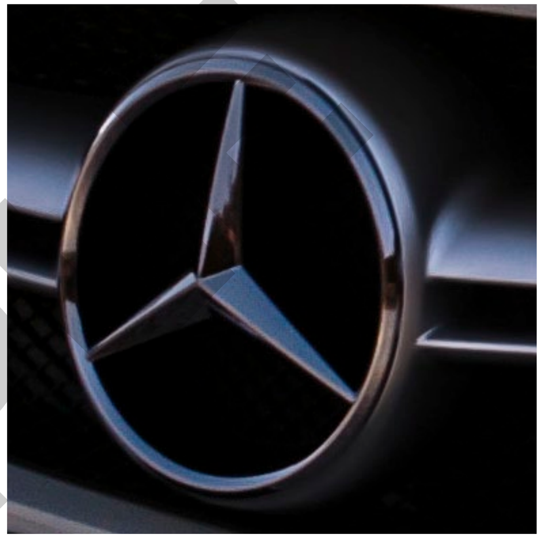

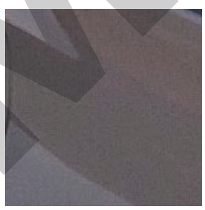

SUPPLYING THE OEMS

Mercedes Benz

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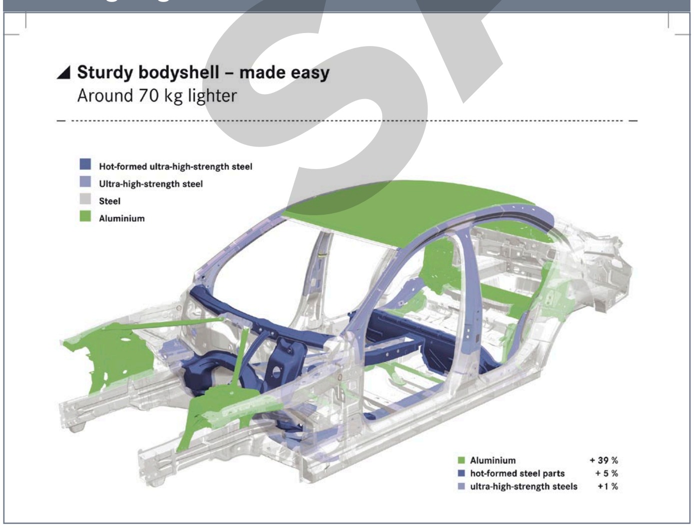
Mercedes-Benz production, ahead even of the MFA (versions of the S-Class and S-Class Coupé using the related MRA Large platform are due for launch in 2020, with total output in 2022 reaching 130,000upa).

Looking at the all-new W205 C-Class, 237,600 units of which were manufactured around the world over 2014, the model features what is termed an 'aluminium hybrid' design. This translates to a platform which uses a judicious combination of both aluminium and various steel grades, with many steel components produced using hot-formed ultra high-strength steel (UHSS). Key aluminium components include diecast crossmembers (used in conjunction with steel equivalents) and longitudinal parts (front and rear fender substructures), cast suspension mounts (front and rear) and the pressed aluminium rear floorpan. This is in addition to the exterior body panels, all of which are made from the lightweight material. According to Mercedes-Benz, aluminium usage is up 39% over the previous C-Class, to a total of 48%, saving approximately 70kg.

There has been a 5% increase in the use of hot-formed UHSS across the W205 chassis, with parts including the engine compartment drivetrain tunnel (and integral crossmember), which further incorporates an additional centralized strut for improved load distribution. The same material is used to produce the floor-mounted crossmember located between the B-pillars. UHSS usage is up 1% over the previous model, with major parts including the roof rails, B-pillars and inner floorpan longitudinals.

Figure 24: The bodyshell of the W205 Mercedes-Benz C-Class saloon is approximately 70kg lighter than that of the out-going version



Source: Mercedes-Benz

There are nine large diecast aluminium components across the body of the car. In most instances, these combine previously individual parts into one larger component, a change supported by the flexibility of the material and the overall production process. This further includes stabilising beads in the floor and bulkhead. Where applicable, high-strength adhesives have been used to bond these parts, further increasing chassis rigidity and improving overall NVH characteristics.

The passenger cell is still largely formed from HSS and UHSS, using panels of gradated thickness to further reduce weight and better withstand specific load stresses. The front longitudinals are bolted to the axle and engine mounts, both made of HSS, so as to translate impact forces towards the bottom of the structure, rather than back towards the passenger cell. Other safety features include side members which for the first time use laser welding to fasten the parts on both sides, greatly improving rigidity and impact absorbsion.

According to Mercedes-Benz, the aluminium hybrid body delivers a weight saving of approximately 70kg over an equivalent structure made of steel. Total vehicle weight is reduced by up to 100kg due to the intensive use of aluminium. This offers a series of further benefits, including a lowered centre of gravity, helping to improve overall performance, and the weight loss cuts fuel consumption by up to 20%.

4. W204 (inc. C-Class, C-Class Coupé, GLK, SLK)

In the 2013 edition of Supplying Mercedes-Benz, the W204 was the most-used platform across global Mercedes-Benz production, with 466,000 units being produced using the architecture over 2012. Introduced in 2007, the W204 was one of the last one-model-range, one-platform systems developed by the OEM, specifically supporting production of the C-Class saloon and its related derivatives. Following an update in 2011, Mercedes stated that 70% of the W204 architecture comprised high-strength steel alloys, while 20% of the bodyshell was made from ultra high-strength steels.

All body parts were produced using fully galvanized sheet, which was further protected with wax-like cavity fill applied in the pre-paint process. Welded seams were protected using a PVC joint sealant compound. Under the car, plastic panelling was used to improve airflow and to protect underside bodywork and powertrain components from road dirt. The chassis used a limited number of aluminium parts, including the front assembly (including the crash box), and an engine compartment crossmember. The hood, front fenders and rear parcel shelf were also made of aluminium.

The last full year of production on the W204 was 2013, following which the platform was phased out in favour of the more flexible Module Rear Architecture (see above section). According to Mercedes-Benz, the new 'aluminium hybrid' architecture uses 39% more of the material than the out-going W204, with the goal of reducing overall vehicle weight so as to improve on-road performance and fuel economy. Just 168,000 vehicles were manufactured using the W204 over 2014, and with negligible output forecast for 2016 and '17, the platform will be consigned to the history books by 2018.

5. NCV3 (Mercedes-Benz Sprinter, Volkswagen Crafter)

The NCV (reported as being New Commercial Van) range of platforms serves as the basis for production of Mercedes-Benz light commercial vehicles. First introduced in 2006, variants of the NCV3 platform are used across production of the Sprinter panel vans, window (combi) vans and chassis cabs (the latter delivered with an exposed rear superstructure for the addition of tipper beds, cool boxes, etc.). The smaller NCV2 supports production of the V-Class (previously the Viano) and Vito vans.

Both platforms are predominantly steel-based architectures, although instead of a standard body-on-frame construction, these vehicles incorporate the steel chassis within a unibody tophat in an 'integral body construction'. This format offers a series of benefits over a purely unibody design, including the ease with which the chassis length can be adjusted to produce a choice of wheelbases (with direct influence on total capacity volumes), while also providing an improved towing capacity.

The boxframe chassis within the NCV3 consists of two parallel beams, or chassis rails, running the full length of the vehicle (apart from versions with an extended rear overhang). These are joined by welded crossmembers, some of which add flanged end pieces for greater strength. At the front of the vehicle, the chassis rails act as the primary support structure for the engine and transmission, while in the rear the crossmembers serve as mounting points for the longitudinal leafspring suspension. The width and thickness of the steel used to fabricate the chassis rails and crossmembers can vary, depending on the intended maximum gross vehicle weight of the vehicle being manufactured.

In most variants power is delivered to the rear axle, although four-wheel drive is available as an option. As the rear driveshaft must be positioned between the frame and body, the structure is marginally higher than equivalent front-wheel drive LCVs. The length of the boxframe chassis dictates the final wheelbase, but the two- and four-door cabs remain unchanged, irrespective of the wheelbase. A special low-frame chassis version is used in assembly of camper van variants. In 2013 (the latest update to the current NCV3 Sprinter), a chassis lowered by 30mm was added as standard to Sprinter versions with a gross vehicle weight of 3.5-tonnes. As this is based on progressive tuning of the suspension and damping, the feature can be deleted at no extra cost.

Figure 25: The Hymer ML-I motor home and the Sprinter chassis platform on which it is based

Source: Mercedes-Benz

The NCV3 was introduced in 2006 and is due for replacement in 2018 with the new NCV4. With the agreement to produce versions of the Sprinter with the Volkswagen Crafter coming to an end in 2016, the next model will also be produced as the Renault Master, which will help to amortize related development costs. It has yet to be confirmed whether the next Sprinter will continue to be sold as the US-only Freightliner Sprinter, but this is likely considering the new assembly plant in South Carolina. With the new Renault deal, annual output on the NCV4 architecture is expected to dramatically increase. At its high point, production on the NCV3 was approaching 230,000 units per annum, but total production on the next version is forecast to comfortably exceed 300,000upa.

6. W164/V251/W166 (Mercedes-Benz M-Class, GL-Class, R-Class)

This internal IHS Automotive platform naming convention refers to the series of architectures used across production of Mercedes-Benz mid- and full-size SUVs and related models. The W164 platform was introduced with the second-generation M-Class SUV in 2005, and an extended version went on to be used in the larger, full-size GL-Class

SUV; W166 refers to the updated version of the platform, launched with the updated M-Class SUV in 2011 – this is sometimes referred to as the third-generation of the model, due to the extensive reworking of the platform and other systems. The V251 is the name given to the version of this platform used in production of the full-size R-Class MPV wagon.

The introduction of the W164 saw Mercedes-Benz replace the body-on-frame construction of the first-generation M-Class SUV with a full unibody construction. The platform was designed from the ground up to support four-wheel drive powertrains, meaning that the vast majority of examples feature the 4MATIC permanent all-wheel drive system (a rear-wheel drive only version of the new GLE was added to the range in 2013).

The W164 platform already featured a robust passenger compartment, protected by front and rear deformation zones, but the revised W166 M-Class model in 2011 further added a series of upgrades designed to reduce impact loads on vehicle occupants. These included a new front axle carrier designed to act as a full crash structure, directing impact forces away from the passenger cell. In addition, an aluminium gearbox crossmember with integrated offset function was designed to channel impact forces through the transmission tunnel (diesel only). Other changes included an A-pillar made from ultra high-strength steels to prevent the front wheels being pushed into the cabin, while deformable sills directed load forces around the passenger cell.

On the vehicle bodysides, weld geometry between the pillars and ultra high-strength steel roof frame were optimised. Additionally, the B-pillar was formed using a tailor-welded blank, with more malleable material in the lower section to better absorb impact forces, and more rigid steel in the top portion. A stiffer floor structure featured a crossmember formed from ultra high-strength steel and in combination with an upgraded driver's seat crossmember, this was designed to reduce the effects of a pole or tree impact. At the rear, the multi-piece longitudinal members were also formed using tailor-welded blanks, giving the parts a continuous closed cross-section with stepped plate thickness, to improve deformation performance and energy dissipation. In 2013, the M-Class underwent an early facelift, largely to support the switch of naming convention from M-Class/ML versions to the new GLE-Class, highlighting the link between the SUV and the E-Class passenger car range. Looking forward, the W166 platform will start being phased out in 2018, as production of the GLE, GLE Coupé (BMW X6 rival) and GLS-Class (formerly GL-Class) SUVs is moved over to the new MHA platform. While no specifics have been released about this architecture, it is safe to assume that most models built on this architecture will use the latest 4MATIC all-wheel drive system. The material mix will feature a considerably higher percentage of aluminium, in diecast, extruded and pressed formats, possibly going so far as to have the full front end structure (firewall forward) fabricated from the lightweight material.

Following the switch of the GLE and its related vehicles to the MHA platform in 2018, total combined volumes are forecast to remain steady at approximately 200,000 units per annum. These, though, will not include the R-Class, which is due to be taken out of production over 2015. The luxury MPV has seen little success in markets outside North America and China, and even at the height of its popularity in 2006, only 37,500 units were produced.

7. W222 (inc. S-Class, S-Class Coupé)

The W222 is the latest in a series of platforms used across production of the flagship S-Class four-door saloon and the related two-door Grand Tourer. This architecture replaced the preceding W221 in 2013, at which point the previous two-door CL Coupé was rebadged S-Class Coupé. As with previous platform generations, the W222 supports a longitudinally-mounted front-engine and rear-wheel drive powertrain, although Mercedes-AMG versions are expected to offer the 4MATIC all-wheel drive system. Other powertrain variants include the new S500 Plug-in Hybrid, which houses the battery pack in the rear of the chassis. Planned long-wheelbase hyper-luxury editions will include the S-Class Maybach and Pullman.

The new platform is still based on a steel passenger cell, but successive generations have seen a greater percentage of both high-strength and ultra high-strength steel grades and aluminium incorporated across peripheral structures to improve on-road vehicle handling, cabin comfort and crash performance. With the W222, aluminium now makes up 50% of the total structure. From the engine firewall forward, the new model uses cast, extruded and sheet aluminium in combination to produce a structure which is almost wholly aluminium in construction.

A usage example sees the shock absorber strut bracket made from diecast aluminium. The flexibility of the material and the casting process has allowed the module to replace a series of individual parts, while the strength of the finished product negates the need for additional reinforcing connections. Morphological analyses were used to determine part geometry and optimum wall thickness to meet functional requirements. Aluminium struts running from the shock absorber bracket to the three-part aluminium cowl (scuttle) provide additional routes for the