

How Fiat will influence Chrysler engineering

By Andrew Marsh

The joining of Chrysler Group to Fiat Auto was one of those moments where apparently both companies were so damaged it was difficult to see what would happen. Thankfully with a strong leader and able staff in both companies not only was adversity met head on, but in the case of Chrysler Group it has flourished beyond everyone's imagination. The results of the main integration of the two companies will become evident in the next few years, starting with the Dodge Dart. Let's consider how that integration is being executed, and the effect on Chrysler engineering.

Fiat, in the beginning....

Fiat has traditionally excelled at two things – technology and small vehicles. Fiat via the production line equipment division gave the world much of the cradle based technology in use around the world today, the current layout for transverse front wheel drive and the idea of re-using big modules in as many vehicles as possible to spread investment risk. Without the production facilities in South America and especially Poland, Fiat would not have been able to produce enough small 'cheap' cars at a profit based on the ever increasingly expensive and strike prone Italian production plants. Added to this, over the past four decades Fiat has thrown those profits away on repeated attempts to bring Lancia back from the dead with unique or heavily adapted models as well as the on-going issues of Alfa Romeo's ever decreasing annual sales.

Fiat is a well-known player in the European automotive industry, and has been frequently one of the more innovative OEMs during its long history. However, towards the end of the last century the underlying issues of rising production costs in Italy, over dependence on the Italian market and an apparent inability to produce profitable compact as well as sub-compact cars threatened dire consequences for the group. By this stage Fiat Agri has acquired Ford New Holland whilst the heavy truck division Iveco has acquired the Ford of Europe heavy truck operation.

There was a brief respite when GM decided to collaborate, and co-invest with Fiat which resulted in access to turbo diesel engines which their other long term technology partner Isuzu struggled to match. In return Fiat got access to GM engines and platforms, and sought to build a luxury line of compacts with a shared platform which would appear as a Fiat, Lancia, Alfa Romeo, Saab, Cadillac and Opel. Not only did that project fail, but GM had to pay off Fiat for lost commercial opportunities to the tune of \$2.3 billion whilst continuing with specific assembly purchase agreements (diesel engines to GM, petrol engines to Alfa Romeo). The GM settlement bought valuable time, as did the Opel Corsa platform which was used for the Fiat Punto.

Fiat search for a new partner

However, Fiat had a saviour. Sergio Marchionne recognised the situation having joined the company in 2002, saw the profits the truck, agriculture equipment and component supply business were making and the paralysis enveloping the whole group. This overnight 'success' of finding another partner was a full 5 years in the making, waiting for his own promotion and market conditions to yield an opportunity for Fiat. It came in 2007, as the banking crisis pushed Chrysler LLC into

administration during 2008, a USA Government with no appetite for mass layoffs, and a European crisis that was critically following just behind.

Less than one year there was a window of opportunity which Sergio Marchionne and his team took to put together a new company to ensure the survival of Fiat by immediately taking it from a predominantly European operation to an international one on one step.



Fiat 500L is not based on 500, and will be available as a minivan as well as a 4x4 SUV. Exports to the USA should start for MY2014.

Fiat acquired Chrysler by achieving technology integration in stages, and by meeting those deadlines was rewarded with slices of equity. Not one Euro passed to Chrysler from Fiat, and not one dollar of the USA rescue funding for Chrysler theoretically passed to Fiat. In 2011 Fiat has amassed a majority share in Chrysler Group LLC by:

- A raft of relatively low cost facelifts right across the Chrysler / Dodge / Jeep range – addressing the primary reasons those products failed in 2007.
- Establishing production of the Fiat 500 in Mexico, along with the Multi-Air 1.4l turbocharged engine, allowing Chrysler LLC to meet US Government demands to produce more efficient vehicles.
- Completed the introduction of four new products – the Dodge Durango / Jeep Grand Cherokee (both based on Mercedes-Benz ML W164 architecture), the RAM 1500 pick-up and the Dodge Dart. This also included the new V6 PentaStar engine which replaced many V6 engines produced within Chrysler up to this point, allowing better profitability for Chrysler Group.

Shared building blocks

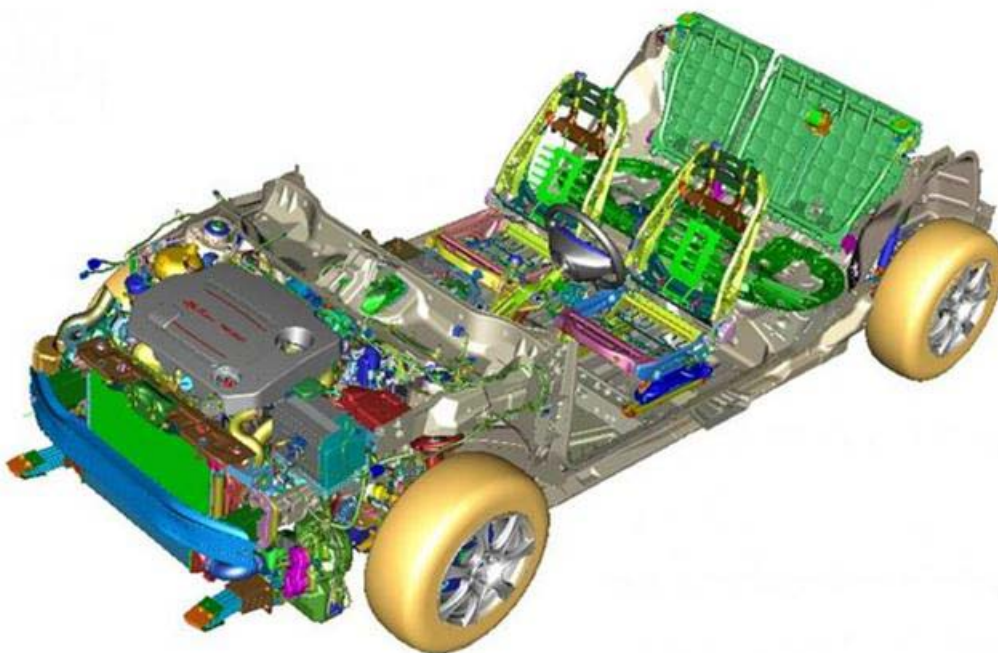
The experiment is pushing ahead with the primary development, funded by the cash flow from the initial low investment steps. The rationalisation now looks like:



Fiat Doblo Cargo (left) becomes a RAM for USA in 2013, as does the Fiat Ducato (right).

- LCV: Fiat Doblo Cargo and Fiat Ducato to be exported to the USA as 'RAM' products.
- Medium sized car and SUV: Using the 'wide' version of the Alfa Romeo Giulietta platform, not only the Dart but replacements for Jeep Patriot / Compass and more will come. This includes an SUV for Europe / China too.
- Large car: Evolution of the Chrysler 300C will provide group wide products from 2015 onwards.
- Large MPV: Evolution of the Chrysler Town & Country / Dodge Caravan into a range of panel vans as well as replacement minivans.

What we see is a distinct trend that the sub-compact sized vehicles regardless of body style will have body technology from Fiat Auto, whilst the larger vehicles will evolve from existing or imminent Chrysler platforms, many of which existed before the near bankruptcy of the latter. In addition, the influence of Fiat can be seen with the introduction of steel alloy grades which are common in Europe to upgrades USA engineered vehicles. It is this one trend that repairers need to be aware of, because Chrysler Group body engineering is more European than ever before in terms of steel strength as well as use of bonding agents in spot welded joints.



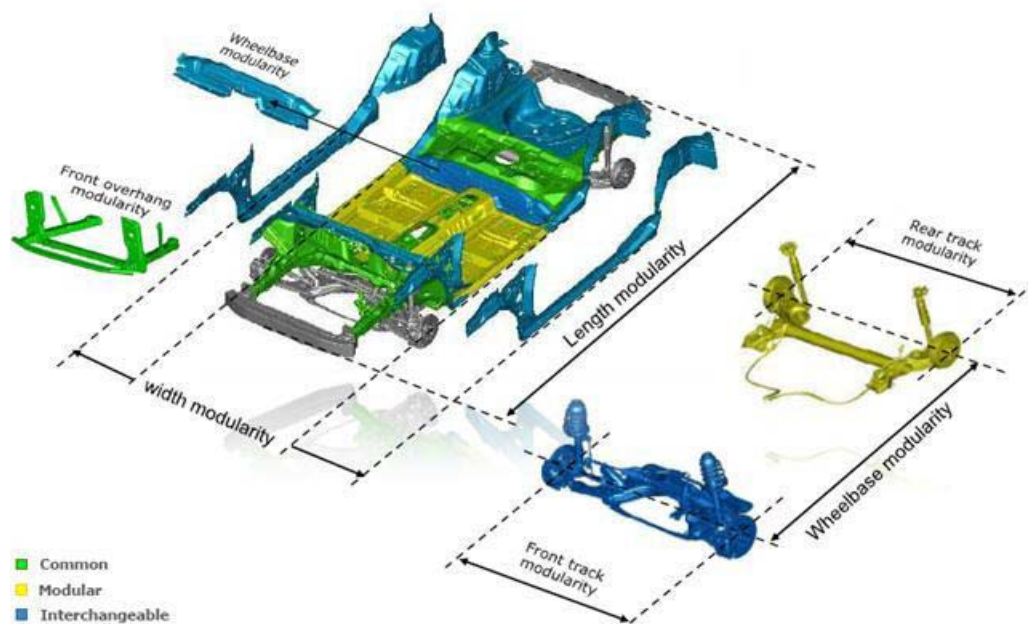
Dodge Dart is just the beginning

The combined Chrysler-Fiat engineering group have carefully recycled as much as possible between the two original company's products. Fiat introduced the 1.4l turbocharged gasoline engine to North America via the 500, and this compact engine will feature in smaller Chrysler Group products in the near future too. Meanwhile the Dart introduced the 'Tiger' gasoline engine family, which is the same 'World Engine' as shared with Mitsubishi as well as Hyundai, but now with a Chrysler specific cylinder head featuring the same valve control system and direct gasoline injection as the 1.4l Fiat engine. Similarly the V6 PentaStar engine will gain the Fiat valve control system ('MultiAir') along with direct gasoline injection to further boost its efficiency.

The Dart is based on the USCW (U.S. 'C' segment Wide) platform, which was grown from the first application of this scalable platform, the Alfa Romeo Giulietta. Unlike the Daimler era engineered Dodge Caliber / Jeep Compass / Jeep Patriot, this is far closer to current European style engineering. The suspension features cast aluminium knuckles and (for the rear) a cast cross member, whilst the 'platform' has common seat frames, HVAC unit, cooling pack mountings, powertrain mounting points and more besides.

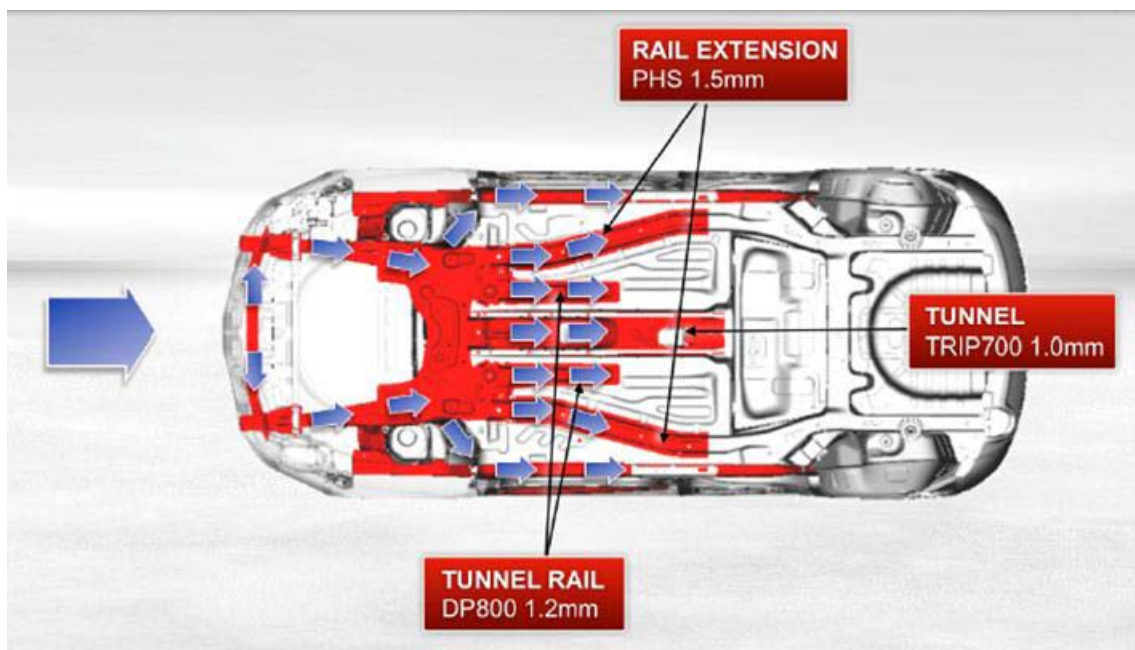
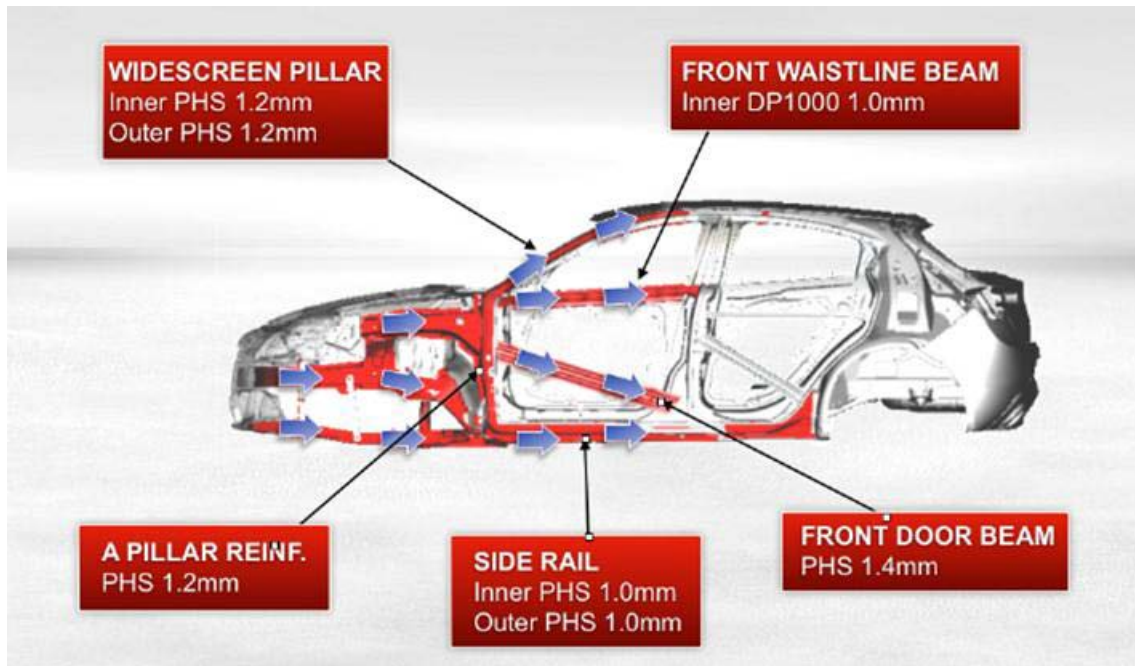
Body structure scalability

The structure was created with modular elements to allow it to be built with variations in wheel base, width and height – in this way the structure can be adapted with minimal additional tooling costs to underpin a compact, sub compact, minivan and an SUV. So, from Alfa Romeo Giulietta came the Dodge Dart sedan, and will come the replacement for the Jeep Compass / Jeep Patriot. The platform has essentially a transverse powertrain with the facility to drive the rear wheels via a power take off for the SUV versions.



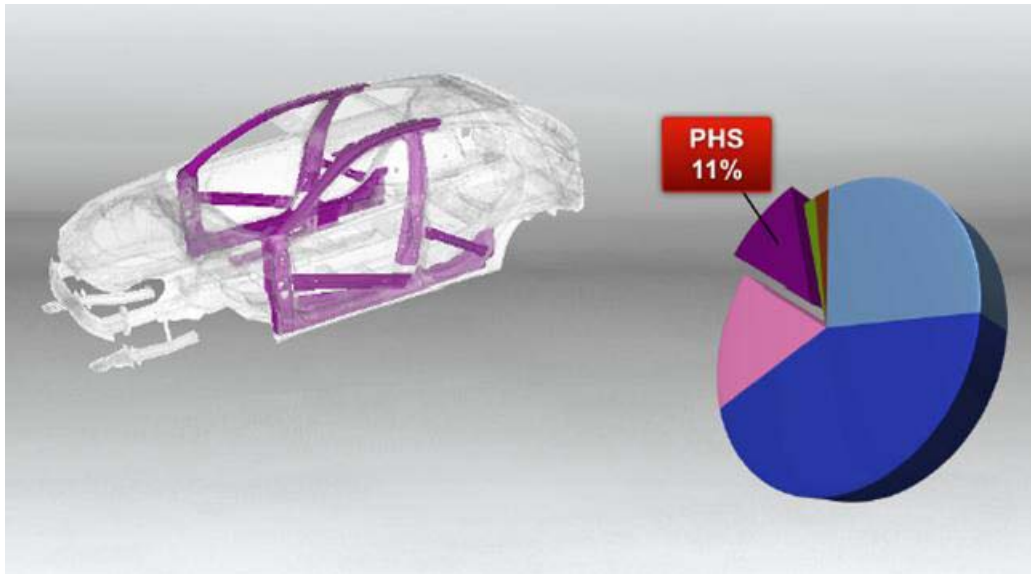
The primary frontal impact load paths are via the front chassis rails, then the front subframe (feeding into the lower body shell) and then finally the upper box members above the front wheels. This

triple load path was first used by Fiat on the 500, and allows a shorter front vehicle section in relation to its capacity to absorb energy.



The underside view of Giulietta shows how the front rail extensions under the floor lower are formed to meet the rockers, so transferring energy further into the shell, away from the point of impact.

The material references use? 'PHS' refers to press hardened boron alloy steel, 'DP' refers to dual phase, whilst 'TRIP' refers to steel which achieves full yield strength after painting in a vehicle production line facility at 160 C. The numbers after the letters refer to the yield strength in MPa – from these two views the lowest strength member is 700 MPa, whereas the press hardened steel alloys will range from 100 to 1200 MPa.



Indeed whilst just 27.9 % of the body shell by mass is made from regular mild steel, at the other extreme 11% is made from press hardened steel alloy. For North American adapted products, the mild steel content will be even lower.

Joining is more often than not via spot bonded joints, as already featured on more recent Chrysler Group products such as the MY12 Chrysler 300C, Jeep Grand Cherokee WK2 and the MY11 Dodge Durango.

Conclusion

Chrysler Group products will continue to adopt body engineering solutions commonly found in Europe faster than almost any other domestic brand, as the pressure to improve gas mileage forces OEMs to seek ways to increase performance whilst reducing weight. The recent revision of the Chrysler 300C with the inclusion of a completely re-engineered upper structure with laser braced roof was done to improve production efficiency, structural integrity and improved NVH. However, the repair solutions for these higher strength steel alloys preclude use of heat to reform damaged panels.

Overall: don't assume a thing, and check the methods from MOPAR or other service providers to make sure repair is done in the correct way for that version of a vehicle which may have been around long before Fiat appeared.

About the Author: Andrew Marsh worked for 24 years as a designer and project manager inside many different OEMs before becoming involved in the vehicle collision repair business over the past nine years. In 2011 he formed a new company with his business partner Ben Cardy to establish unique engineering resource specifically written for the vehicle collision repair business - autoindustryinsider.com. Check out the site, and get in touch via email (andrew.marsh@autoindustryinsider.com or ben.cardy@autoindustryinsider.com) if you want to know more.