



ArcelorMittal

Multi Material Approach to 54.5 mpg by 2025
Dr. P. K. Rastogi
Oct 3rd 2013



Agenda

- An Overview of ArcelorMittal
- Automotive Market Forecast
- Key Drivers/Enablers
- AHSS Solutions for 54.5 mpg in 2025
- Future Material Trends
- Conclusion



The world's leading steel and mining company

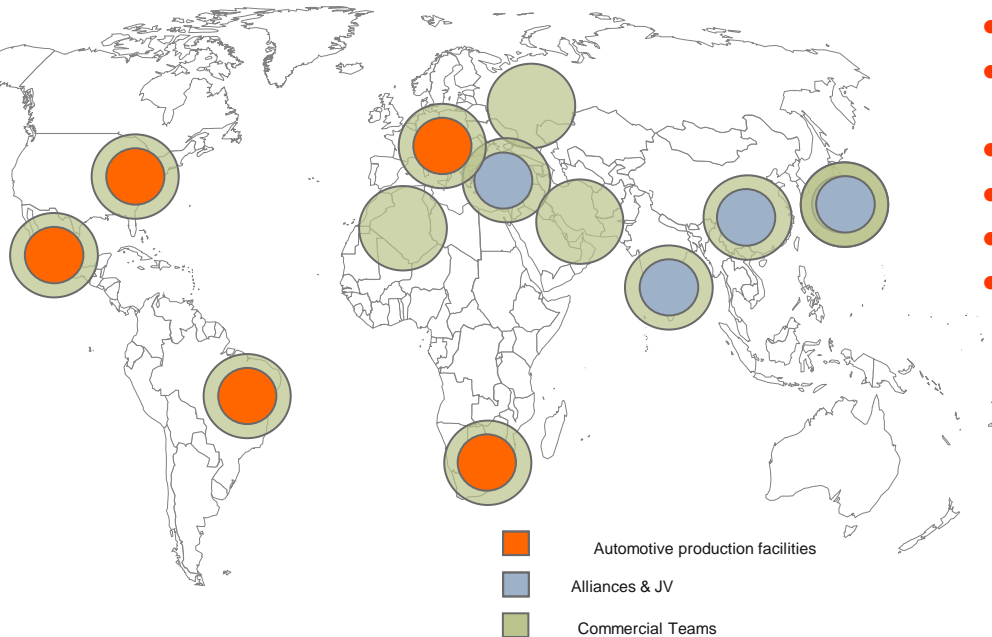
- ArcelorMittal is the world's number one steel and mining company, with around **246,000** employees in more than **60** countries. ArcelorMittal is the leader in all major global steel markets, including automotive, construction, household appliances and packaging, with leading R&D and technology, as well as sizeable captive supplies of raw materials and outstanding distribution networks.
- An industrial presence in **20** countries exposes the company to all major markets, from emerging to mature.
- ArcelorMittal values geographical breadth, product diversity and raw materials security. Approximately **39%** of our steel is produced in the Americas, **44%** in Europe and **17%** in other countries such as Kazakhstan, South Africa and Ukraine.

Underpinning all our operations is a philosophy to produce safe, sustainable steel



Our leadership in automotive steel

ArcelorMittal's industrial and commercial network

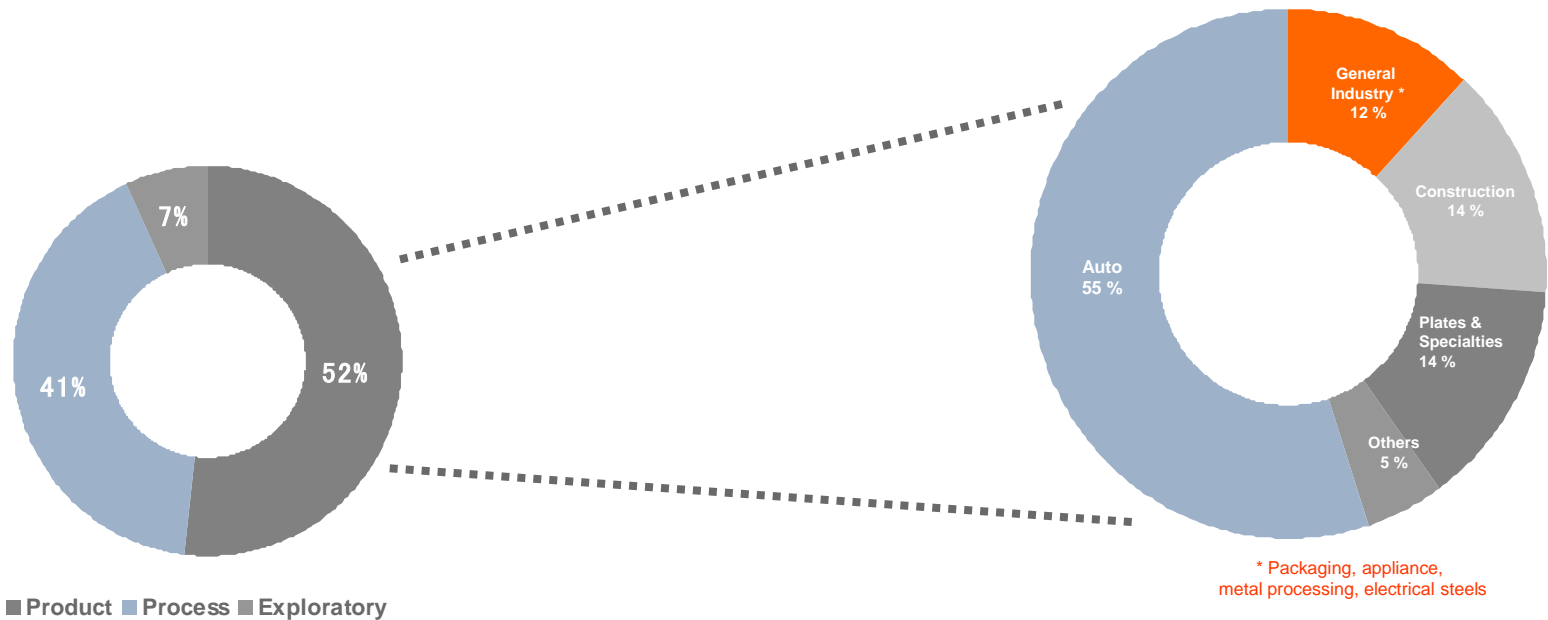


- Global automotive manufacturing presence (own facilities, alliances and JV)
- Proximity to the customer by global presence of commercial teams
- Global distribution network
- Unique product offerings to meet demand for safety, fuel economy and reduced CO2 emission
- Relative stability of margin
- 40% market share in our core markets
- Strong investment in R&D
- Barriers of entry due to technical know-how requirements for value-added products and customer relationships

We are serving globally while developing industrial assets in emerging markets

ArcelorMittal global R&D expertise

- 1,300 full time researchers
- 2012 spending of \$285 million
- Broad, comprehensive portfolio and programmes addressing business needs
- Worldwide network of laboratories (currently 11 labs in Europe and North America)
- Budget spending by focus area:



R&D effort fully aligned with group strategy



Supporting car makers' vision and strategy



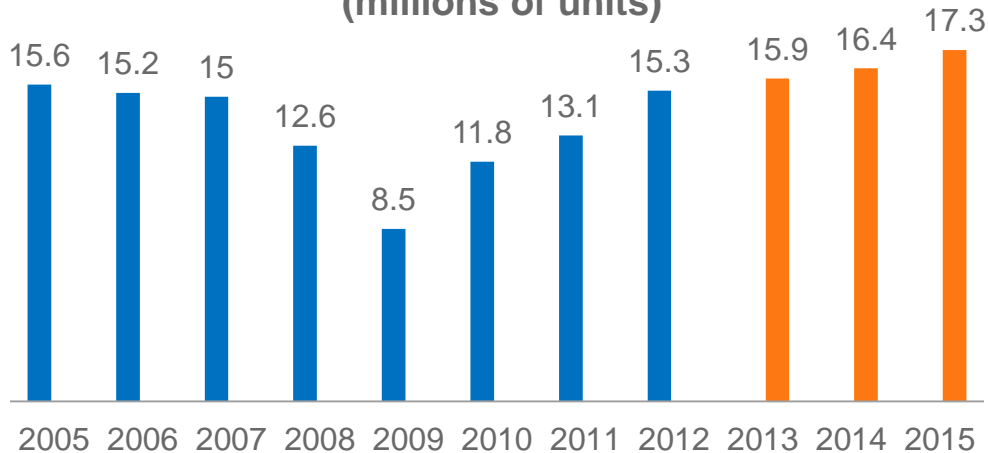
Through strong partnerships, our teams address automotive challenges by developing efficient and innovative solutions.



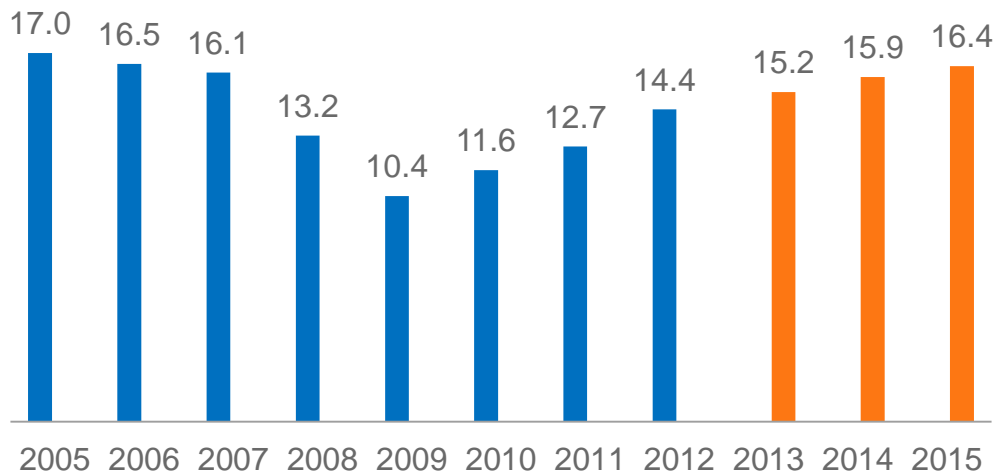
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North America Auto Production (millions of units)



US Auto Sales (millions of units)

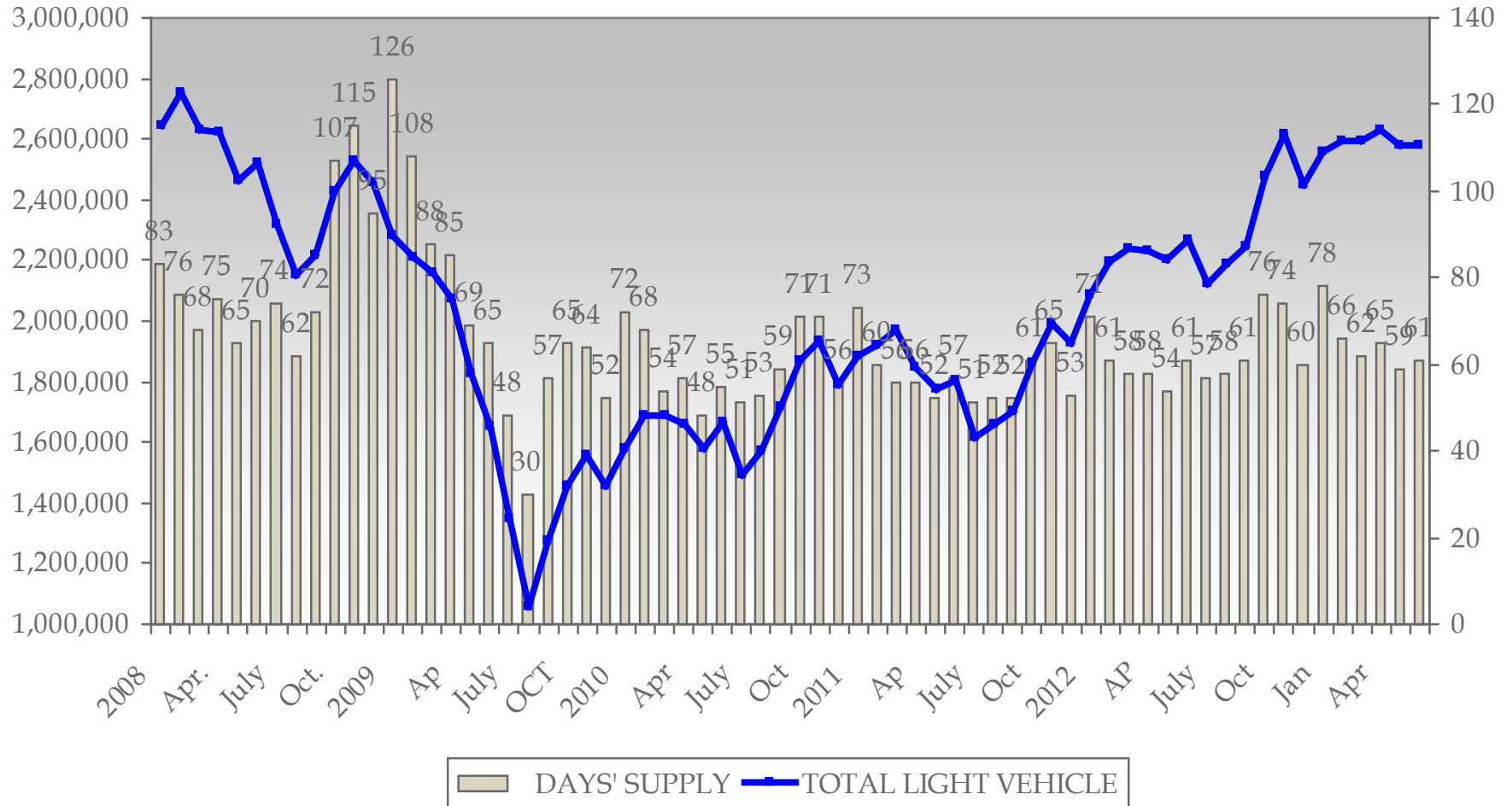


- As the economy gradually improves pent-up demand for new vehicles is being released. The average age of vehicles on the road is now over 11 years.
- Fleet sales were low from 2009 through 2012, adding to pent-up demand. This demand is also being released in 2013.
- Auto credit markets are improving.
- As the housing market improves demand for pickup trucks is improving.
- While gasoline prices are high, improved fuel economy of new vehicles has become a positive for sales. Also, OEMs now offer more high mileage vehicles than in the past.
- Although the unemployment rate is not improving significantly the workforce is increasing every month and this adds to demand for new vehicles.
- No significant increase in the pace of sales is expected the rest of this year.
- As the market recovers to previous levels the YOY pace of improvement is slowing.



Light Vehicle Inventory - Units

Light Vehicle Inventory - Days Supply



Source: Wards Automotive



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Key Market Drivers

- Stiff Fuel Economy and Reduced Emission Requirements
- Enhanced Safety/Performance
- Escalating Gasoline Prices
- Sustainability
- Consumer Price Sensitivity

Industry Enablers for Improving Fuel Economy

- **Mass Reduction**

- Increased use of AHSS's and UHSS's for Mass Reduction
- The use of Alternative Materials to Steel – Aluminum, Magnesium, Carbon Fiber, Composites, etc.....

- **Improvements in Powertrain Efficiency**

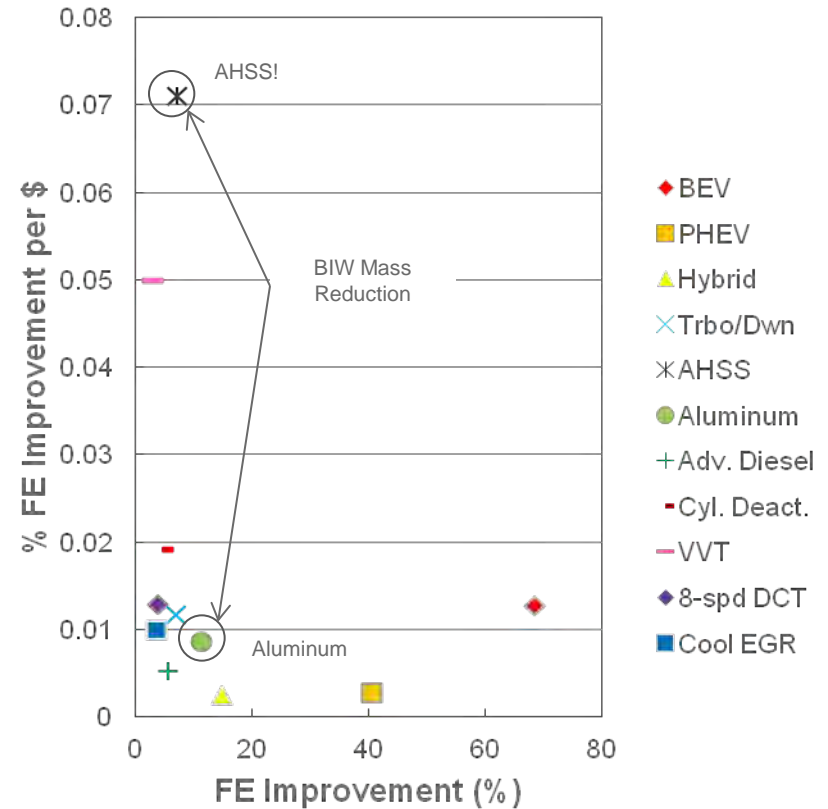
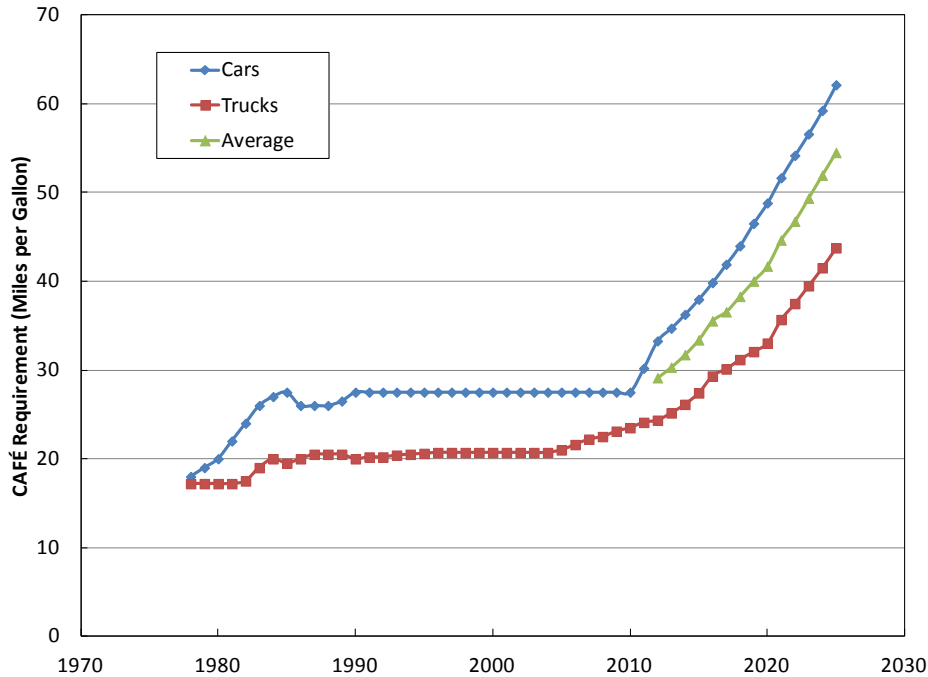
- Alternative Powertrains/Hybridization
- Small Turbocharged Engines
- Diesel's
- More Efficient Transmissions
 - 6 and 8 speed automatics
 - CVT's

- **Improved Aerodynamics**

- **Reduced Rolling Resistance**

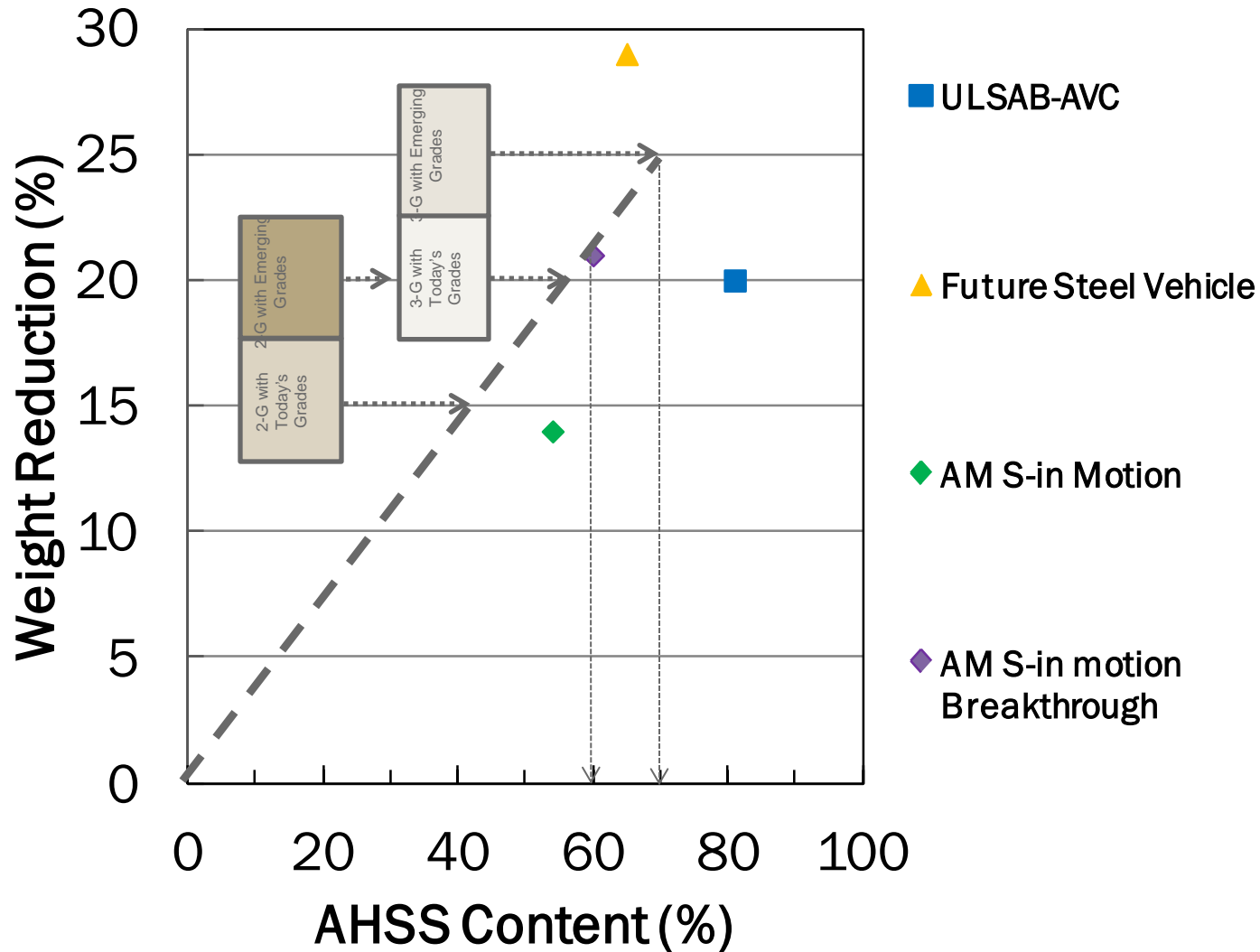


2012-2025 US CAFÉ Rules



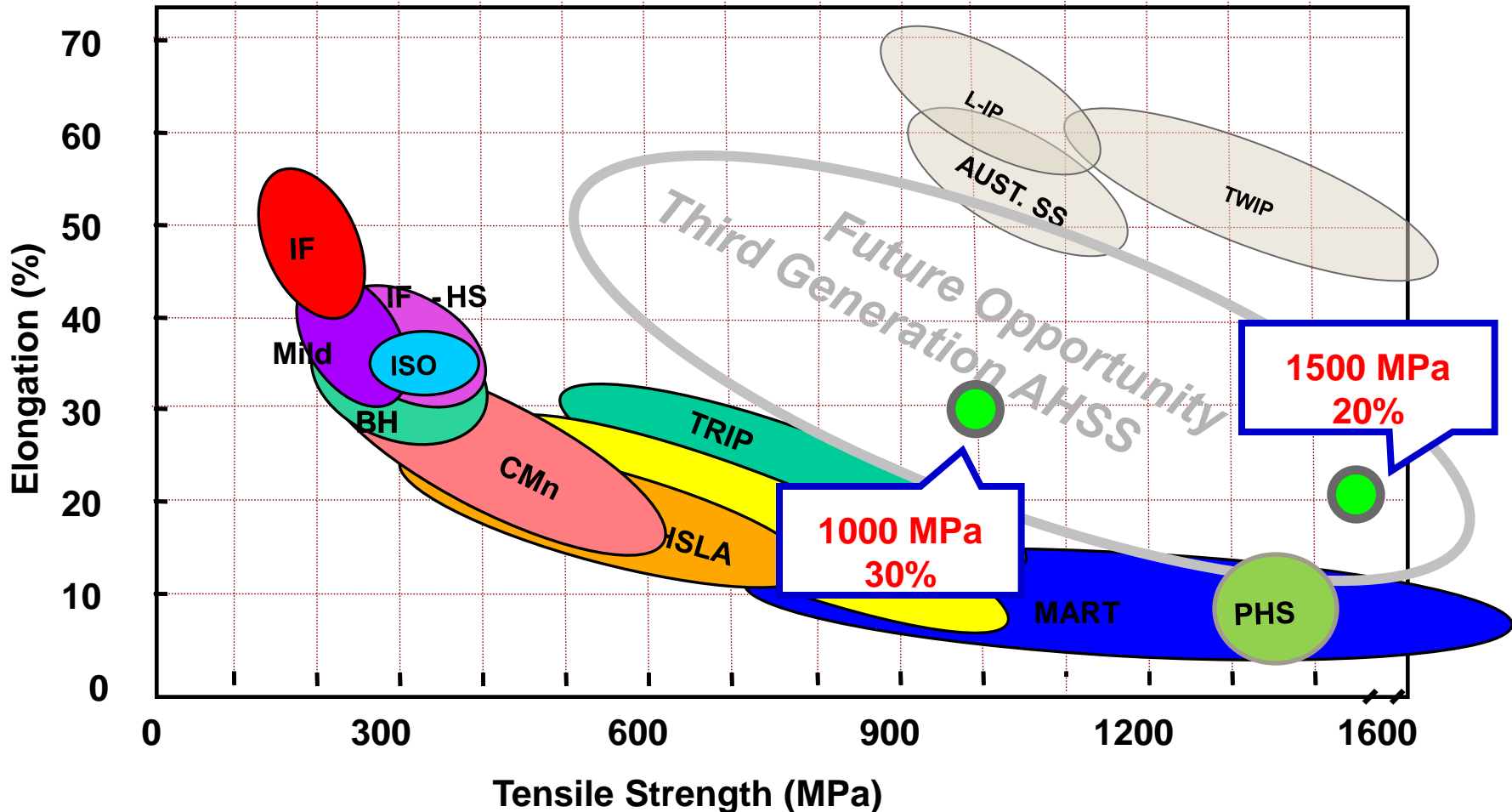
- New CAFÉ Regulation: 54.5 MPG (2025)
- Fuel economy mandate for each vehicle is foot print driven (track x wheel base)
- Weight reduction by AHSS: the most cost effective way for improving fuel economy

How much weight reduction can Steel provide?



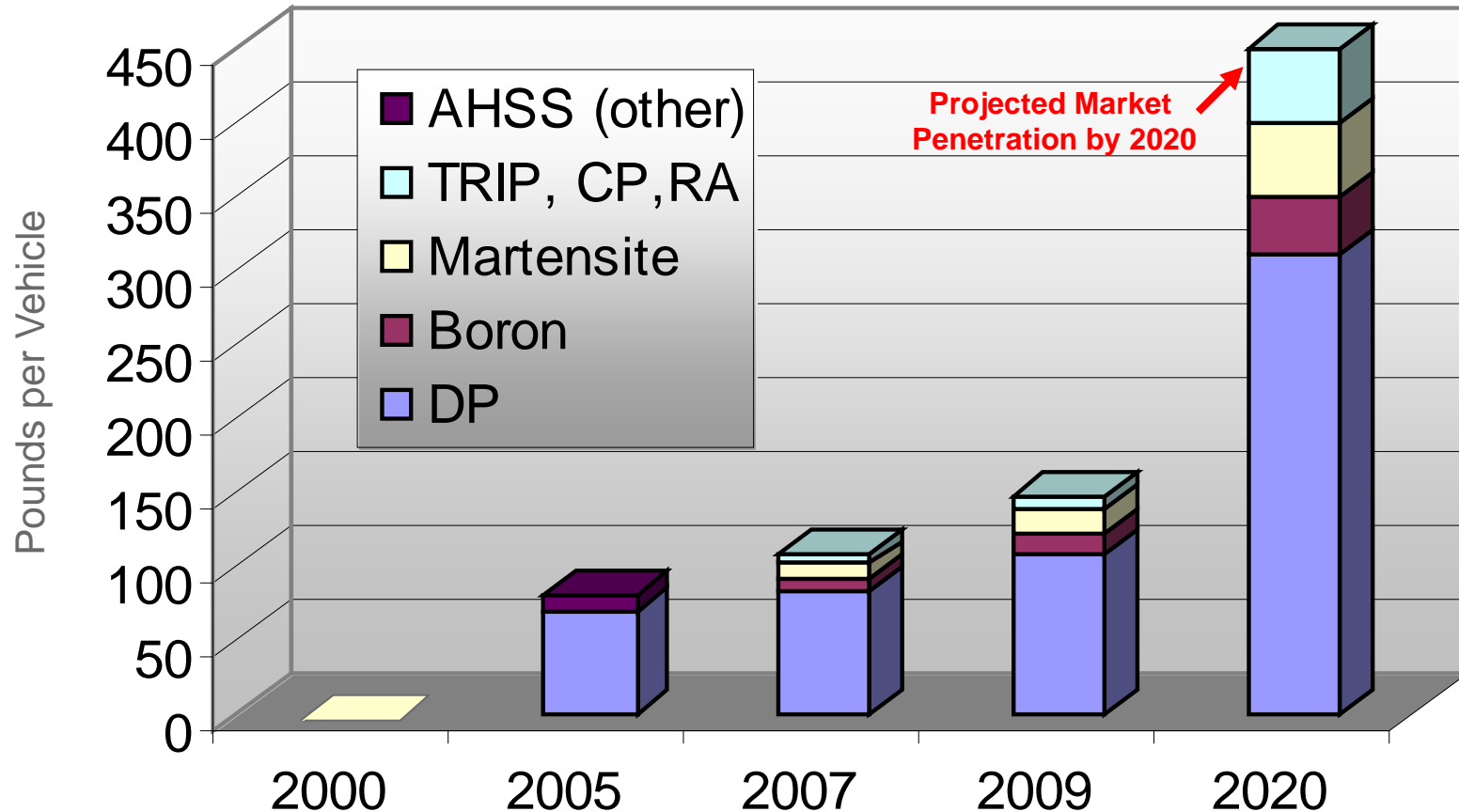
Steel Property Combinations Identified as “Breakthrough Steels” for Automotive Applications

Future Opportunities in 3rd Generation AHSS



AHSS Growth in NA Vehicles

AHSS - Fastest Growing Automotive Material



Source: Ducker Worldwide 2009

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3G (Gauge/Grade/Geometry) AHSS Solution for Weight/Cost Reduction

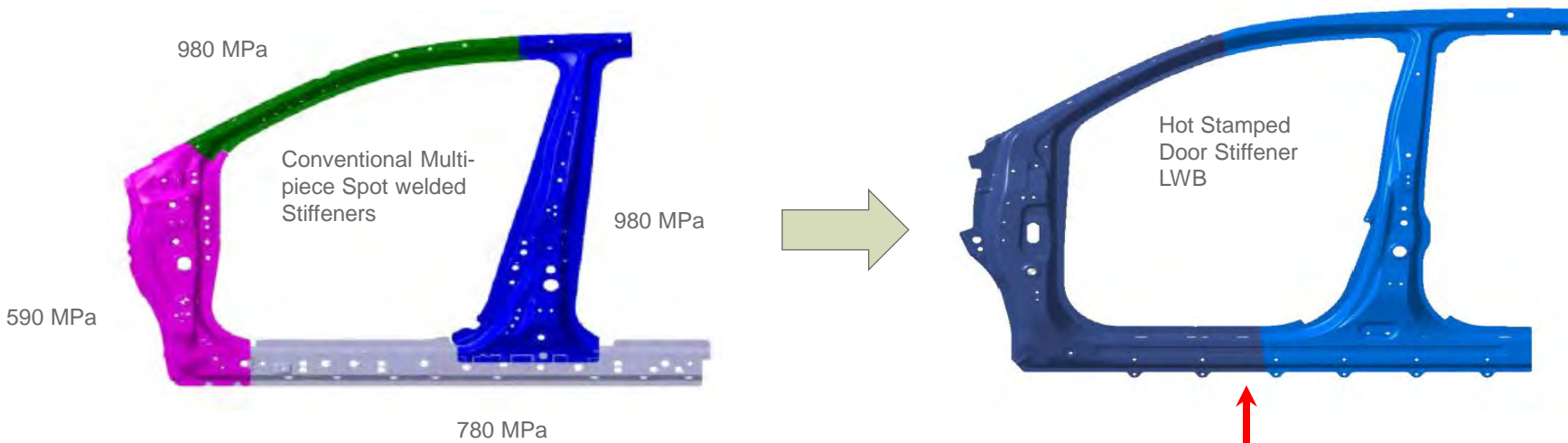
Case Studies:

- LWB Door Ring Design for 2014 Acura MDX
- Roof Rail/B-Pillar Solution for 2013 Ford Fusion
- Ultra Light Weight Door System



Door Stiffener LWB vs. Conventional Design

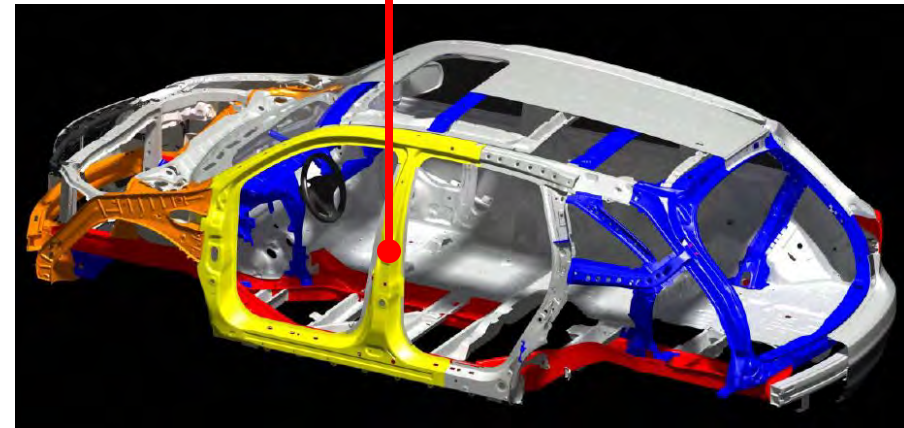
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MDX Door Stiffener LWB

■ Key Benefits

- Weight reduction ~ 3.1 kg
- Simplified vehicle assembly
- Reduction in assembly weld stack-ups
- Better Fit and Finish
- Better Crash performance
- Improved Fuel Economy
- Improved Material Utilization
- Meets total cost targets



Courtesy: R. ZumMallen, J. Riggsby, Honda R&D Americas
Automotive Engineering Congress, Nuremberg 5-6 June, 2013

AHSS Roof Rail/B-Pillar Application in Ford 2013 Fusion

Holistic Material/Design/Process:

- Steel: AHSS 980T/550Y
- Roof Rail and B-Pillars: Hydroformed Tubes
- **About 6kg weight savings/car**
- Meeting/exceeding performance
- Significant cost savings

Note: Received 2013 Platts Global Metals Award in London



AHSS in Roof Rail and B-Pillar Safety Parts



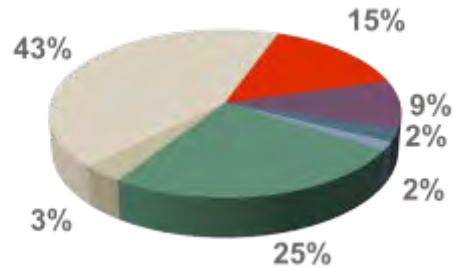


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C-segment Lightweight Steel Door System Solution: Potential Weight Savings: 6.2 kg (18.2 kg vs. 12.0 kg)

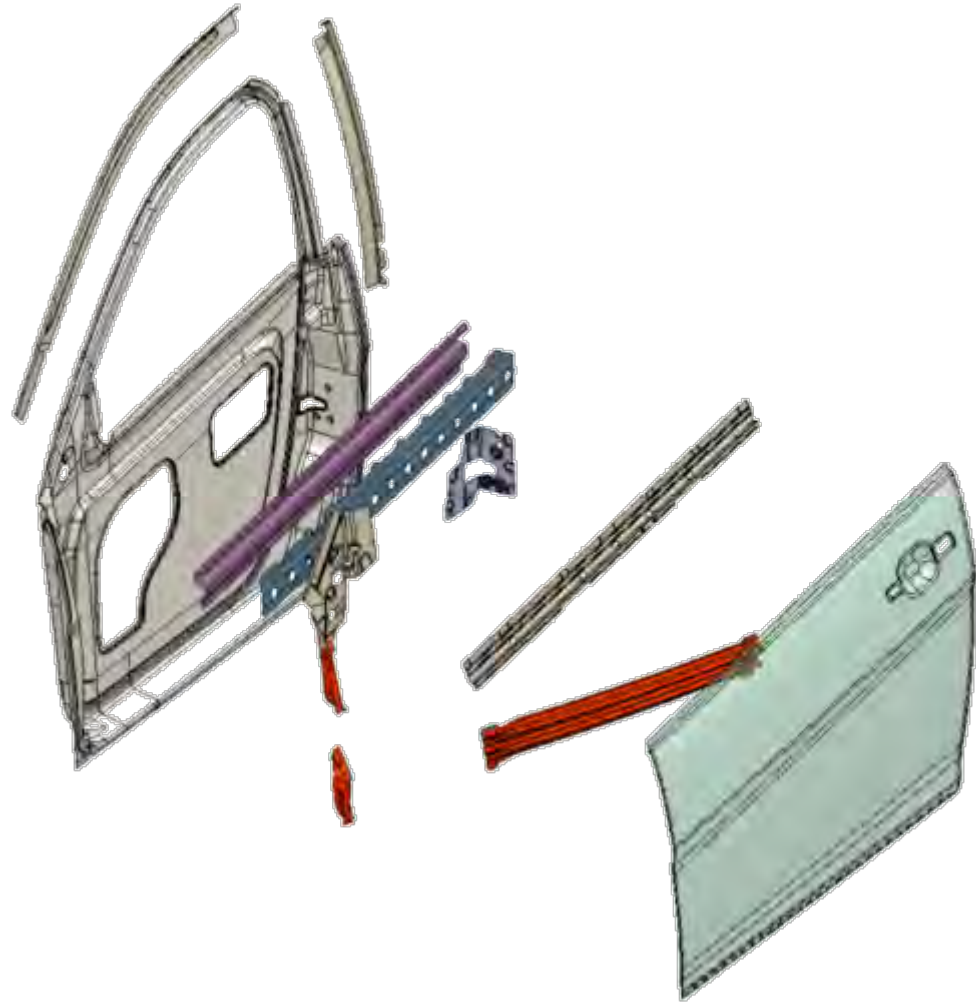
12.0 kg

Weight: - 6.2 kg (- 34%)



- PHS ≥1300MPa
- AHSS ≥1180MPa
- AHSS ≥900MPa
- AHSS ≥780MPa
- AHSS ≥590 Mpa
- AHSS ≥450MPa
- HSS
- Mild steel

Tensile strength values



High res picture available for download on
www.arcelormittal.com/automotive

Ultra Lightweight Steel Door Solution

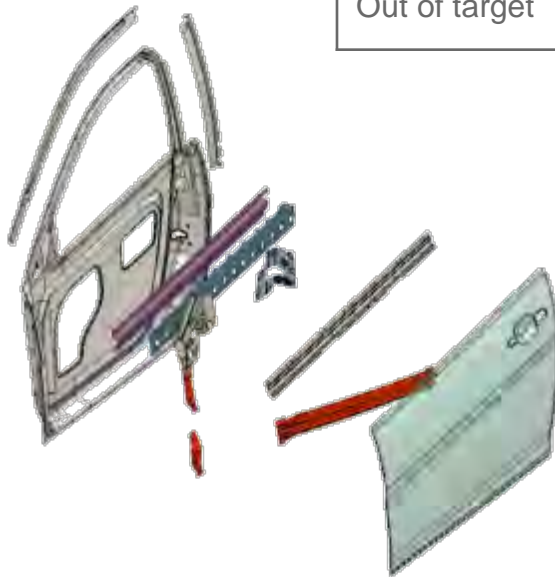
Performance Results



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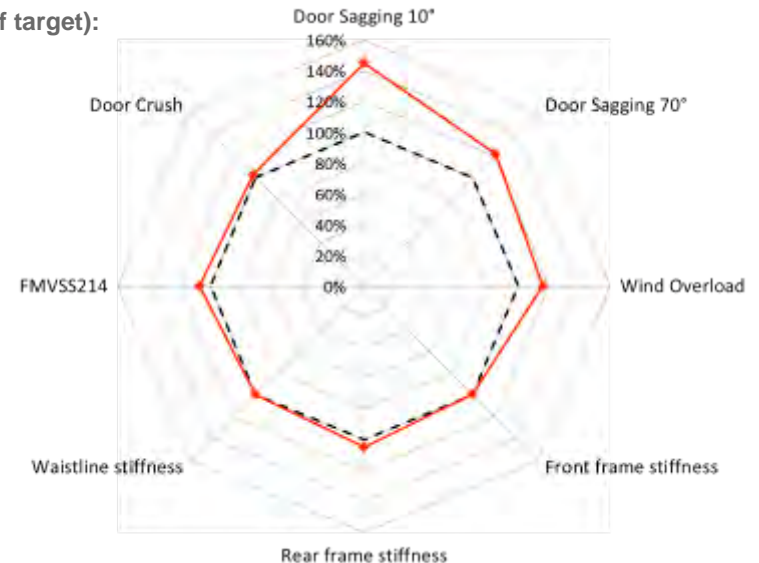
Performance criteria

Above target	🎯
Close/at target	🟢
Close/below target	⚠️
Out of target	❌



STATIC	Door Sagging 10°	🎯
	Door Sagging 70°	🎯
	Door Overpull	🎯
STIFFNESS	Front Frame Stiffness	🟢
	Rear Frame Stiffness	🟢
	Waistline Stiffness	🟢
CRASH	Front Crash	🟢
	FMVSS214S Side Impact	🟢

Performance (% of target):



Weight: **12.0 kg**

Potential weight savings: **6.2 kg / 34%**



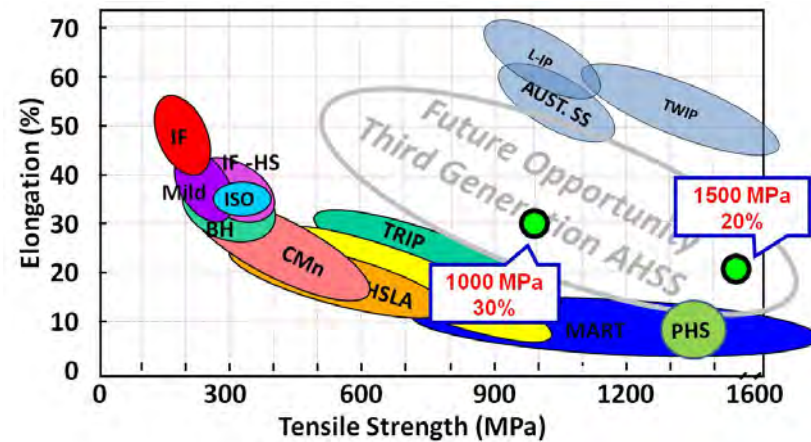
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Future Material Trend

- “Improved” Second Gen AHSS’s
- Higher Strength Martensite and PHS up to 2 GPa!
- “Breakthrough” and Third Gen AHSS’s
 - 1000 MPa and 30% elongation
 - 1500 MPa and 20% elongation
 - High Modulus and Low Density Steels
- Aluminum
- Magnesium
- Advanced Composites/Carbon Fiber?





Conclusion

- 25% BIW weight reduction potential offered by today's and breakthrough steels, combined with other known and anticipated fuel economy improvement technologies can get the 2025 fleet to 54.5 MPG
- Steel offers the means to attain the requisite 2025 fuel economy requirement of 54.5 MPG at a lower per-vehicle cost than if BIW light weighting were accomplished by the substitution of aluminum or carbon fiber
- To assure the achievement of 25% BIW weight reduction in most vehicles, a significant portion of ArcelorMittal's near-term and breakthrough grades are at various stages of commercial development
- **Future vehicle will be based on multi- material strategy with AHSS as a mainstream/cost-effective solution for meeting regulatory, performance and safety requirements**