Lightweighting automobiles with steel

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The world's leading steel and mining company

- Employs approximately 222,000 employees in more than 60 countries
- Leader in all major global steel markets, including automotive, construction, household appliances and packaging, with leading R&D and technology, sizeable captive supplies of raw materials and outstanding distribution networks
- Industrial presence in 19 countries exposes the company to all major markets, from emerging to mature
- Approximately 38% of our steel is produced in the Americas, 47% in Europe and 15% in other countries such as Kazakhstan, South Africa and Ukraine
- Sales of $80 billion and EBITDA of $7.2 billion in 2014

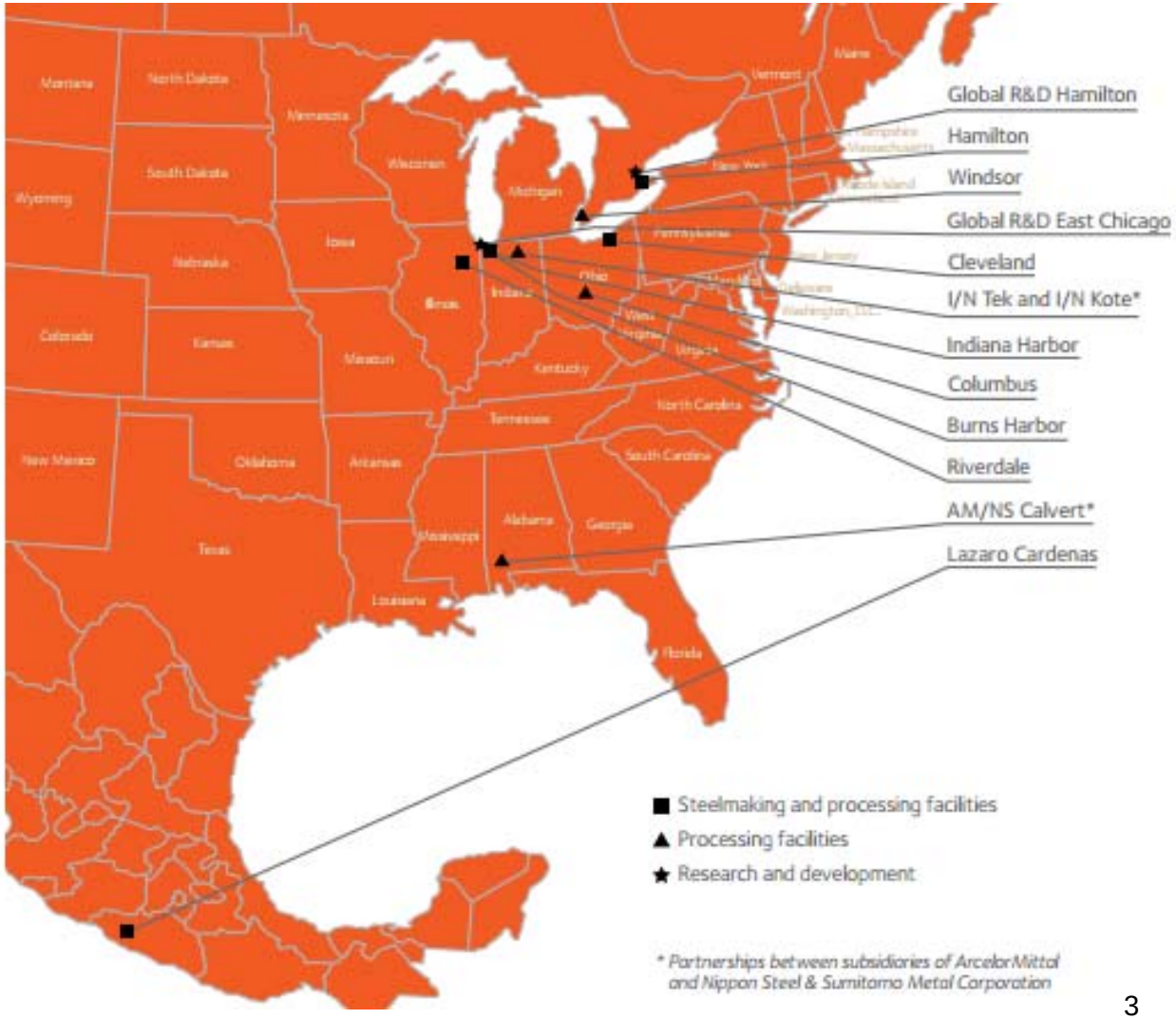
Underpinning our operations is a philosophy to produce safe, sustainable steel

ArcelorMittal in auto

- Largest sheet steel producer in the world
- Largest steel supplier to all major automakers
- Steel solutions provider – pioneer in co-engineering with key automotive customers
- Automotive end uses for steel include body structures, closures, chassis, frames
- Six major R&D labs focused on automotive market, with 565 employees and $90 million annual budget:
  - East Chicago, Indiana, USA
  - Hamilton, Ontario, Canada
  - Tubarao, Brazil
  - Montataire, Maizieres-les-Metz and Gandrange, France

Strategically located to serve North American automotive market

- Six steelmaking and processing facilities
  - Burns Harbor
  - Cleveland
  - Dofasco
  - Indiana Harbor
  - Lazaro Cardenas
  - Riverdale
- Four finishing facilities
  - AM/NS Calvert
  - Columbus
  - I/N Tek & I/N Kote
  - Windsor



Automotive drivers and trends

Reduced Mass / Improved Fuel Economy

Performance Requirements (Safety, Durability, NVH, Quality)

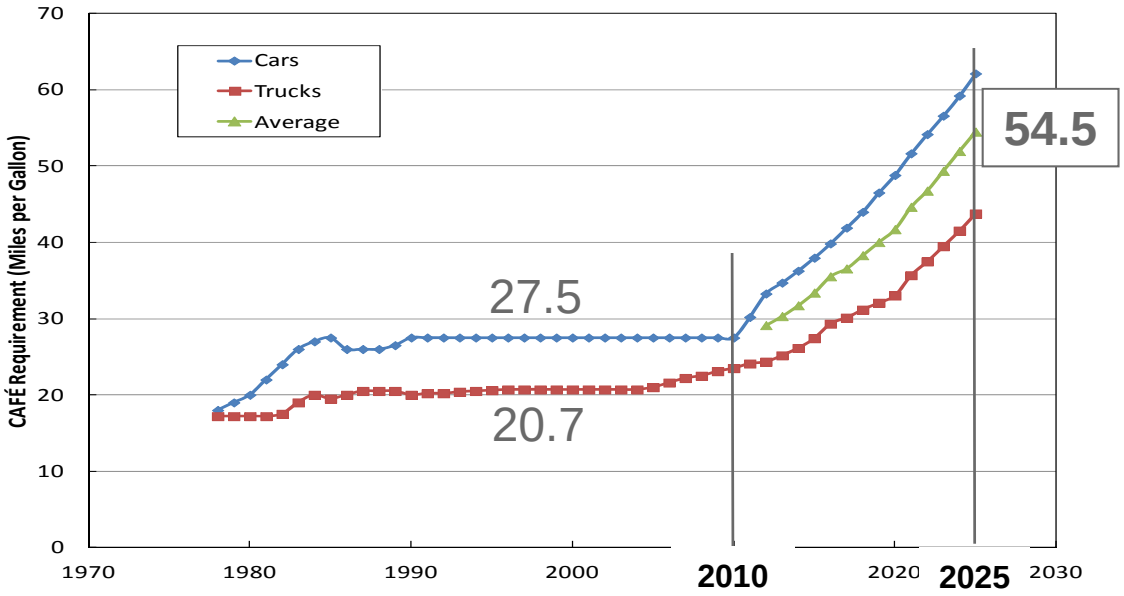
Cost Reduction / Avoidance

Environmental

Globalization

Competitive Material Assessment

Faster Concept to Production



- Powertrain improvements
- **Mass Reduction**
- Reduced aerodynamic drag
- Low rolling resistance tires

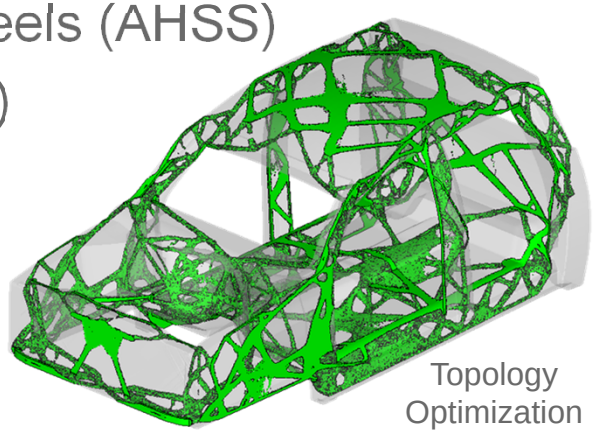
Fuel economy improvement due to 10% reduction in curb weight:	
With powertrain re-sizing	6%
Without powertrain re-sizing	3%

Sources: WorldAuto Steel, Auto/Steel Partnership

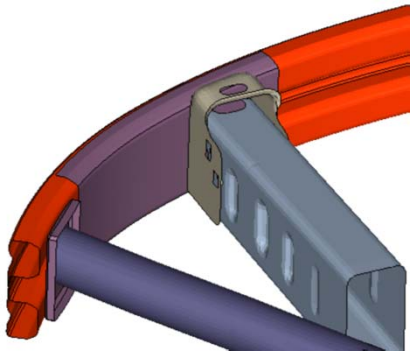
An extremely challenging scenario for automakers!

Steel lightweighting technologies

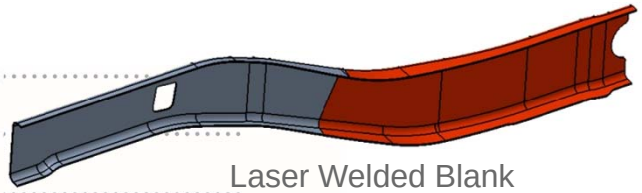
- Advanced High Strength Steels (AHSS)
- Laser Welded Blanks (LWB)
- Hot Stamping (PHS)
- Tubular solutions
- Structural optimization
- Innovative designs



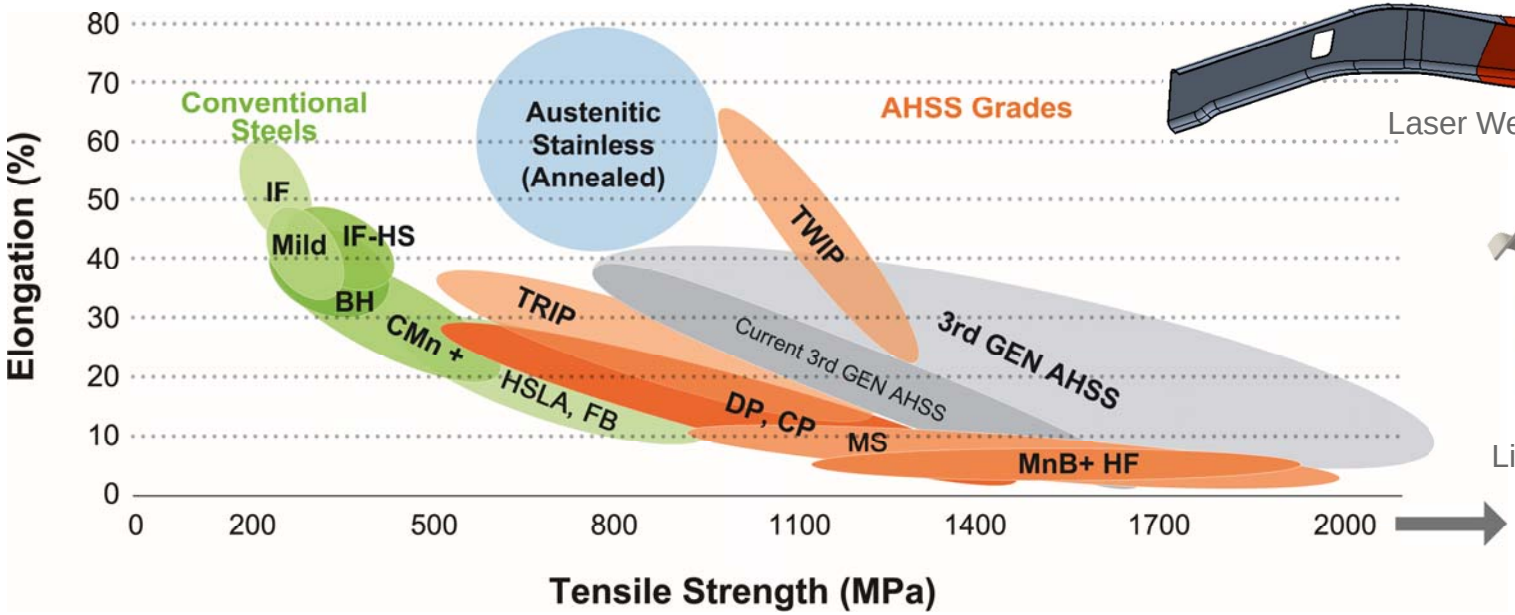
Topology Optimization



DP 780 Tube



Laser Welded Blank

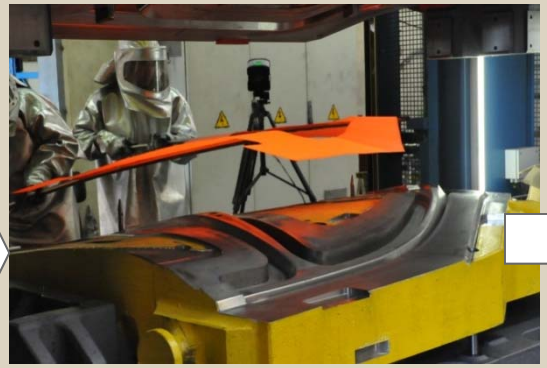


Lightweight designs

Hot Stamping (Press Hardening Steels)

Hot stamped LWB Door Ring: key steps of the process

Austenitization (heating) of blanks



Transfer of blanks

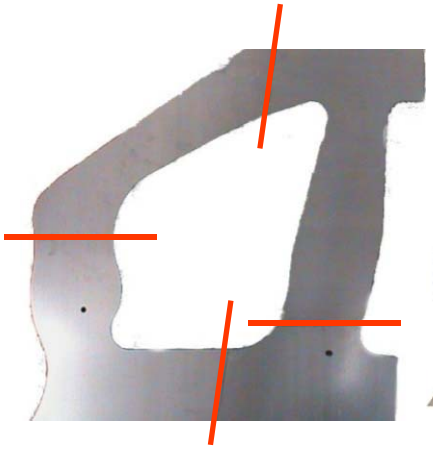
Hot forming + die quenching

Hot stamping trial conditions:

- Furnace temperature: 930° C
- Blank dwell time: 5 minutes
- Transfer time: 8 seconds
- Die closing time: 4 seconds

} **Prototyping (manual transfer)**

- Quenching time: 20 seconds
- Laser trimming
- Part tolerances: +/- 1mm or better
- Typical strength in finished part: 1500 MPa tensile, 1000 MPa yield.

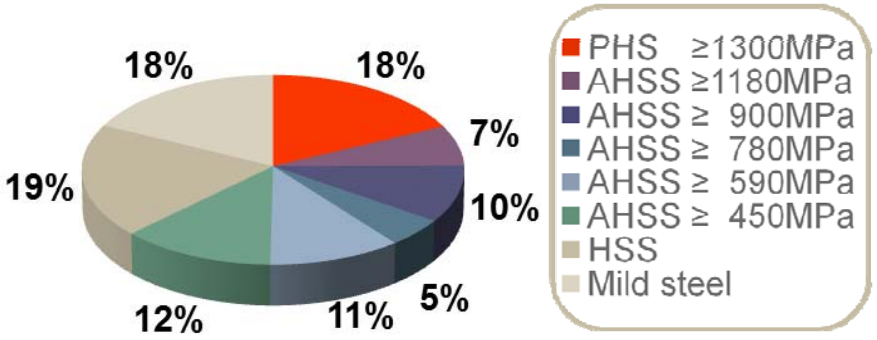


Laser Welded Blank Usibor ® 1500

S-in motion® Laser Welded Blank Door Ring

S-in motion® Pickup Truck

- ArcelorMittal steel pickup solution: **574 kg**
  - Cab + Doors: 286 kg (375 kg baseline)
  - Box + Tailgate: 100 kg (129 kg baseline)
  - Frame: 188 kg (243 kg baseline)
- **174 kg (23%)** of weight savings compared to baseline weight (**748 kg**)
- Solutions are validated for crash and stiffness requirements
- Main complex parts are validated for forming and assembly
- ArcelorMittal steel pickup solution with emerging grades saves an additional **22 kg**
- **196 kg (26%)** of weight savings compared to baseline weight with emerging grades
- Steel solution compatible with small overlap crash test (SORB) adds only **5 to 8 kg**



Tensile strength values

Steel Pick-up weight breakdown (current grades)

63% AHSS & PHS

Processes

• Hot stamping	37 parts
• Stamping of LWB	17 parts

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