Magnesium Cross Car Beam – 3 Generations
IMPROVING THE FUEL ECONOMY OF OUR AUTOMOBILES
1. Meridian Overview
2. Material Properties
3. 3 Generations Jaguar CCB
4. Enablers for Mass Reduction
5. Keys to Success
We Are The Lightweight Heavyweight

Meridian is the leading full service supplier of innovative lightweight magnesium die cast components and assemblies in the global automotive market.

- Magnesium and Aluminum alloy casting capability
- Worlds largest producer of magnesium components
- In-house design and advanced engineering
- Die casting magnesium since 1981
- Over 1,600 dedicated employees
- 63 total die-cast machines from 500 to 4,500 tons
- 28 die cast machines 2,500 tons and over
- Secondary machining, coating, and assembly capabilities
Global Manufacturing & Customer Service Footprint

Our strategic global presence enables us to service the international needs of our automotive clients quickly and efficiently.

- Eaton Rapids, Michigan: Manufacturing Facility
- Plymouth, Michigan: Business Development Program Management
- Strathroy, Ontario: Global Technology Center Program Management, 2 Manufacturing Facilities
- Coahuila, Mexico: Manufacturing Facility
- Sutton-In-Ashfield, Nottinghamshire, UK: Business Development Manufacturing Facility
- Munich, Germany: Business Development Program Management
- Xinchang, China: Manufacturing Facility
- Jilin, China: Manufacturing Facility
- Shanghai, China: Business Development Manufacturing Facility

- 4 North American Manufacturing Sites
- 1 European Manufacturing Site
- 3 Asian Manufacturing Sites
- 3 International Sales Offices
Product Development Timeline

1985: Steering Column Parts
1987: Instrument Panels
1990: Front of Dash
1994: Center Console
1998: Front End Structures
2001: Header Bow
2003: Engine Cradle
2005: Steering Wheel
2006: Liftgates
2008:
2009:
2010:
## Material Property Comparison

### Die Cast Magnesium Alloys

<table>
<thead>
<tr>
<th>Material</th>
<th>Density (g/cm³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnesium</td>
<td>1.8</td>
</tr>
<tr>
<td>Aluminum</td>
<td>2.7</td>
</tr>
<tr>
<td>Steel</td>
<td>7.8</td>
</tr>
</tbody>
</table>

**Lightest Structural Material**

<table>
<thead>
<tr>
<th>Property</th>
<th>AZ91D</th>
<th>AM60B</th>
<th>AM50A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile Strength (Mpa)</td>
<td>240</td>
<td>225</td>
<td>220</td>
</tr>
<tr>
<td>Yield Strength (Mpa)</td>
<td>160</td>
<td>130</td>
<td>125</td>
</tr>
<tr>
<td>Elongation (%)</td>
<td>3.0</td>
<td>6.0</td>
<td>8.0</td>
</tr>
<tr>
<td>Density (g/cm³)</td>
<td>1.81</td>
<td>1.80</td>
<td>1.77</td>
</tr>
<tr>
<td>Elastic Modulus (Gpa)</td>
<td>45</td>
<td>45</td>
<td>45</td>
</tr>
</tbody>
</table>
Benefits of Magnesium for Cross Car Beams

Why consider magnesium content for instrument panel design? Magnesium is the ideal material for applications where weight saving is a priority, as it has the lowest density of all structural metals. Almost as light in weight as plastic, magnesium has the advantage of greater strength and rigidity.

- High part complexity, low additional cost
- Part function integration to reduce or eliminate machining
- One piece designs are quieter than multi-piece designs
- Absorbs energy and reduces vibration (Crash and NVH)
- 5-6 Kg lighter than steel
- One tool, one casting, one tolerance stack
- Tunable through localized ribbing and wall stock adjustments
- Implementation ready technology
- 32 magnesium cross car beams currently in production
Cross Car Beam Development History

Jaguar Land Rover

1998
Initial development with JLR

2002
X202 XF Mg CCB Production

2008

2015
X250 Mg XF CCB Production
X260 XF Mg CCB Production
Initial Development Studies (1998)

Jaguar Land Rover Cross Car Beam
1st Generation Cross Car Beam
2002-2008 Jaguar S Type X202
Part Weight: 5.2 kg
Alloy: AM60B
2nd Generation Cross Car Beam
2007-2013 Jaguar XF X250
Part Weight: 5.7 kg
Alloy: AM60B
2015 Jaguar XF Cross Car Beam Development

Step 1 - Benchmarking

Current Best-in-Class Around 4.0kg
2015 Jaguar XF Cross Car Beam Development

Step 2 - Optimizing Studies

Current functionality maintained

Weight Saving = 0.85kg

Final Weight = 4.85Kg (Current 5.7Kg)
2015 Jaguar XF Cross Car Beam Development

Step 3 – Setting Targets

**Targets:**

- Weight: 3.7kg – based on optimization studies
- Multi-platform design – X760 & X260
- Machining: Zero – based on business case
- Manufacturing: 2 Cavity – based on business case

- Boundary condition sensitivity analysis
- HVAC
- Steering column NVH
- HVAC NVH
- Side impact load path
- Tunnel leg traction load path
2015 Jaguar XF Cross Car Beam Development

Weight Avoidance

Additional CCB “lift point alleviates the need for “unnecessary” material to meet “sag” structural requirements.
3rd Generation Cross Car Beam
2015 X260 Jaguar XF and X760 XE

Part Weight: 3.64 kg
Alloy: AM60B

- New platform – clean sheet
- FEA technology
- FEA capability
- Aggressive biz case targets.
- Challenges from other technologies
Cross Car Beam Development

Enablers for Mass Reduction

- Reduce wall section thickness
- Eliminate need for GBR to cut through HVAC
- Elimination of steel brackets
- Vehicle body stiffness and attachment scheme
  - Side cowl, upper and lower plenum driver tunnel
- Column NVH
  - Attachment to magnesium beam
- Cockpit build strategy
  - HVAC attachment to IP and/or body
- Packaging design upfront with performance targets
Cross Car Beam Development

Keys to Success

- Experienced JLR Cross Car Beam engineer with Magnesium know-how
- Experienced supplier with design development capability with multiple OEM’s
- Advancements in FEA software
- Growing experience in optimization for weight & performance
- Benchmarking and optimization studies conducted
- Realistic target weight established
- Clear vehicle architecture strategy
- Business case established at the outset
  - 3.7 kg
  - No Machining
  - 2 cavity tooling
- Release Engineer managing the weight and machining content
Let it be Light
Contact Information

We extend our sincere appreciation to you for taking the time to learn about our company and the services we provide. We welcome the opportunity to discuss future business opportunities and relationships, please contact us to learn more.

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Thank you for your time.
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