HCV - Hybrid Commercial Vehicle

http://hcv-project.eu/

2010-2013
Management Structure MAGNA Int.

<table>
<thead>
<tr>
<th>Role</th>
<th>Name</th>
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<tbody>
<tr>
<td>Chief Executive Officer</td>
<td>Don Walker</td>
</tr>
<tr>
<td>Chief Financial Officer</td>
<td>Vince Galifi</td>
</tr>
<tr>
<td>Chief Marketing Officer, President Magna Asia</td>
<td>Jim Tobin</td>
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<tr>
<td>Chief Legal Officer</td>
<td>Jeff Palmer</td>
</tr>
<tr>
<td>COO Magna Interiors, Exteriors, Seating, Mirrors, Closures and Cosma</td>
<td>Tom Skudutis</td>
</tr>
<tr>
<td>Chief Technology Officer</td>
<td>Swamy Kotagiri</td>
</tr>
<tr>
<td>Chief Human Resources Officer</td>
<td>Marc Neeb</td>
</tr>
<tr>
<td>President Magna Europe</td>
<td>Guenther Apfalter</td>
</tr>
<tr>
<td>VP Operational Improvement &amp; Quality</td>
<td>Mike Sinnaeve</td>
</tr>
</tbody>
</table>

MAGNA SEATING
- Mike Bisson
  - President
MAGNA EXTERIORS
- Joe Pittel
  - President
  - Acting President
MAGNA INTERIORS
- Albert Lidauer
  - President
MAGNA MIRRORS & MAGNA CLOSURES
- Frank Seguin
  - President
MAGNA INTERNATIONAL
- John Farrell
  - President
MAGNA POWERTRAIN & MAGNA ELECTRONICS
- Jake Hirsch
  - President
MAGNA STEYR
- Guenther Apfalter
  - President

Seating
- Exteriors
- Interiors
- Vision, Closures & Lighting Systems
- Body & Chassis
- Powertrain & Electronics
- Vehicle Eng & Contract Mfg; Fuel, Battery & Roof Systems
Global Presence

~ 128,000 People   |   29 Countries   |   315   |   82   |   $34.8 Billion (2013 Sales)
(As of Q1 2014)
We offer ...

Engineering services including complete vehicle development

Flexible solutions from niche to volume production

Fuel systems and compressed-air tanks

Innovative battery systems

Entire range of roof systems
Battery Systems / Worldwide Presence

(Status Q2 2013)

250 employees
2 locations in Europe
1 location in North America

North America
Auburn Hills

Austria
Graz
Zettling

Production
Engineering Services & Production
Engineering Services
Battery Systems Locations Europe

- Austria (Europe)
  Employees: 171 (Status Q3 / 2013)
  Plant Size: 14,060 m²

- Functions
  Battery Pack Engineering
  Prototype Battery Builds
  Battery Pack Assembling
Graz

- **Austria (Europe)**
  - **Employees:** 25, Total 6,500 (Status Q1 / 2013)
  - **Plant Size:** 1,200 m², Total 800,000 m²

- **Functions**
  - Battery Testing
  - Material Testing
  - Battery Pack Assembling
Battery Systems Location North America

Auburn Hills

- Michigan (USA)
  - Employees: 48 (Status Q3 / 2013)
  - Plant Size: 7,630 m²
- Functions
  - Battery Pack Engineering
  - Battery Testing
  - Material Testing
Innovative Battery Systems

- Battery Pack Development & Production
  based on state-of-the-art lithium-ion cell technology

- HEV Battery Packs
- PHEV / REX Battery Packs
- EV Battery Packs
- Low Voltage Battery Packs (12V & 48V)
- Truck / Bus HEV Battery Packs
- Cell, Module and Battery Pack Testing
- Material Testing

- Excellence in automotive engineering and production
- Deep knowledge of international safety standards
- Integrated thermal and electronic management
- Customizable solutions due to modular design
- Leading Li-ion battery provider for commercial vehicle segment
Battery Testing Laboratories

Battery Testing Lab Graz
- Energy Efficiency
- Cycle Life & Calendar Life
- Thermal Performance
- Peak Power
- Cold Cranking
- Self Discharge
- Pulse Power Characterization
- Capacity Determination
- SOx Algorithm Tests
- OCV Characterization
- Max. Current
- Customer Load Cycle
- Environmental Testing Lab Capabilities

Battery Testing Lab Auburn Hills
- Energy Efficiency
- Cycle Life & Calendar Life
- Thermal Performance
- Peak Power
- Cold Cranking
- Partial Discharge
- Self Charge & Fast Charge
- Constant & Variable Power Discharge
- Hybrid Pulse Power Characterization
- Static Capacity
- Operating Set Point Stability
- Stand
- Sustained Hill Climb

Battery Test Channels
- Location
  - Graz
  - Auburn Hills
- Battery Pack Level
  - Graz: 11
  - Auburn Hills: 20
- Module Level
  - Graz: 3
  - Auburn Hills: 8
- Cell Level
  - Graz: 18
  - Auburn Hills: 349
- Climatic Chambers
  - Graz: 5
  - Auburn Hills: 57

- Best Cycling, Thermal & Data Acquisition Systems On The Market
- ISO 17025 Certification
Matrix of Battery Pack Applications

- **EV*** Electric Vehicle
- **PHEV*** Plug In Hybrid Vehicle
- **HEV*** Hybrid Electric Vehicle

- **12 / 48V SYSTEMS POWER BATTERY PACKS**
- **MILD HEV*** POWER BATTERY PACKS
- **FULL HEV*** POWER BATTERY PACKS
- **PHEV*** ENERGY BATTERY PACKS
- **EV*** ENERGY BATTERY PACKS
- **TRUCK/BUS HEV*** HEAVY DUTY POWER BATTERY PACKS
Main targets in HCV Project

**Contribution to overall project targets**
- Average 40% cost reduction at power train level
- 5% fuel consumption reduction at vehicle level

**Magna contributes at battery system level**
- Advanced research activities to improve battery technology
- Development, verification, integration and commissioning of a battery storage system prototype based on an advanced lithium ion cell.
- Target vehicle: 18-ton Volvo bus/6-ton Iveco-Altra Van
Outcome of HCV

- **Battery storage system prototype based on**
  - a new battery concept and
  - an advanced lithium ion cell

- **Improved Life Time**
  - Advanced cell technology
  - Advanced Operating Strategy
  - Improved accuracy of system parameter determination
    - Advanced algorithms
    - Advanced electronics

- **Reduced Production Cost**
  - Modularity at system level
  - Optimizing the production process
  - Others (change of suppliers, price negotiation, ...)

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**Early 2nd Generation**
- 330 MWh → 470 MWh

**Advanced 2nd Generation**
- 176 MWh → 250 MWh

- **Cost Reduction**
  - 64 %
  - 51 %
Future Activities

• **Development for the future Bus / Truck - Hybrid**
  - Strong cooperation partners in further innovation projects
  - To the needs of the market

• **Research in future Cell Technology**
  – International Research Partners
  – International Industrial Partners
  – Cooperation in research projects

• **Development of new markets**
  – New segments of eMobility
  – Non-Automotive Markets