Aluminum and Vehicle Lightweight Strategy
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Saber Haidous
Global Commodity Manager
Raw Materials
General Motors
Lightweight Material History
Aluminum & Magnesium

Magnesium

- VW Engine
- Racing Wheels
- Metro-lite Trucks
- Buick Car of the Future (hood)
- GM IP
- Mercedes Door Inner
- GM Transfer Case
- BMW Mg/Al Block
- GM Engine Cradle

Aluminum

- Bugatti Type 10
- Model T hood
- Pistons
- Blocks and Heads
- Radiators
- Al Hoods
- Audi AIV

Years:
- 1900’s
- 1910’s
- 1920’s
- 1930’s
- 1940’s
- 1950’s
- 1960’s
- 1970’s
- 1980’s
- 1990’s
- 2000’s
Materials - Current and Future State

- Conventional steel still dominates vehicle structure
- Lightweight materials slowly making their way into vehicle make up
- Projections show significant rate of growth for lightweight materials
- In short term, lightweighting can be achieved by replacing heavy steel component with lighter material
- In long term technology will have to drive change

Source: US Department of Energy

Typical composition of past and present cars versus a future lightweight vehicle.
The Need for Technology

- Starting in 1982, vehicle weight started to increase due to larger cabin volumes, added safety and environmental requirements.

- Despite weight increase, improvement in fuel efficiency continued.

- Demand to reduce greenhouse gas and use of oil require additional solutions for improving fuel efficiency (including lightweighting and propulsion systems).
Why Aluminum?

Recyclability

Mass Reduction

Better Fuel Economy

Enhanced Performance

Improved Safety

Emissions Reduction
While we are Getting Lighter We Must Stay Focused

- Maintain Safety (This is the **Highest Priority**)
- No Quality Compromise
- Maintain Performance
- Be Efficient (Meet or exceed CAFE fuel efficiency guidelines)
- Keep Cost Contained
- Aluminum has 40-60% weight reduction potential vs. steel
Aluminum Content Forecast

Source: Ducker Worldwide

The trend line continues to be supported by new aluminum applications.

- 2009: 327 lbs.
- 2012: 343 lbs.
- Projected: 550 lbs.

3.5% CAGR
Are OEMs Looking at Aluminum as a Major Route Towards Lighter Vehicles?

- **BMW**: Plans to use more aluminum to cut vehicle weight. (Reuters)
- **Audi**: Relies on aluminum to reduce weight by up to 20% as seen on the 2011 A8, while increasing stiffness, (Audi/ATG Press release 2012)
- **Nissan**: Announced a goal to reduce vehicle weight by 15% (Automotive News)
- **Ford Motor Company**: Intends to take 250 to 750 lbs. out of each model (Bloomberg)
- **General Motors**: Expects to trim between 500 and 1,000 lbs. from light trucks by 2020. (Automotive News)
Examples of Lightweighting

• Camaro Z28
  Replacement of 20 inch aluminum wheels with 19-inch forged aluminum wheels reduced vehicle weight by 49.6 lbs.

• C7 Corvette Stingray
  Aluminum Frame
  Mass saved: 45 kg vs. C6
Examples of Lightweighting

- General Motors first aluminum door structure, saving \(~18\text{kg/vehicle}\) from the steel door system, and
  \(~25\text{kg/vehicle}\) from the Gen 2 CTS

2014 Cadillac CTS
Key Aluminum Opportunities

- Creative technological approach must be in the forefront.
- Aluminum is a major factor in the quest to lightweight but is not and will not be the only player.
- Supply base must be creative and innovative to develop cost effective alloys and must work closely with OEMs.
- Closed Loop Recycling is critical, important, and cost effective. Suppliers and OEMs must work closely together to develop and maintain successful strategies.
- Cost reduction is imperative. Initiatives to include more efficient aluminum processing must be explored.
- Improved collaboration between aluminum companies is central to success.