



Advanced Light Metal Applications

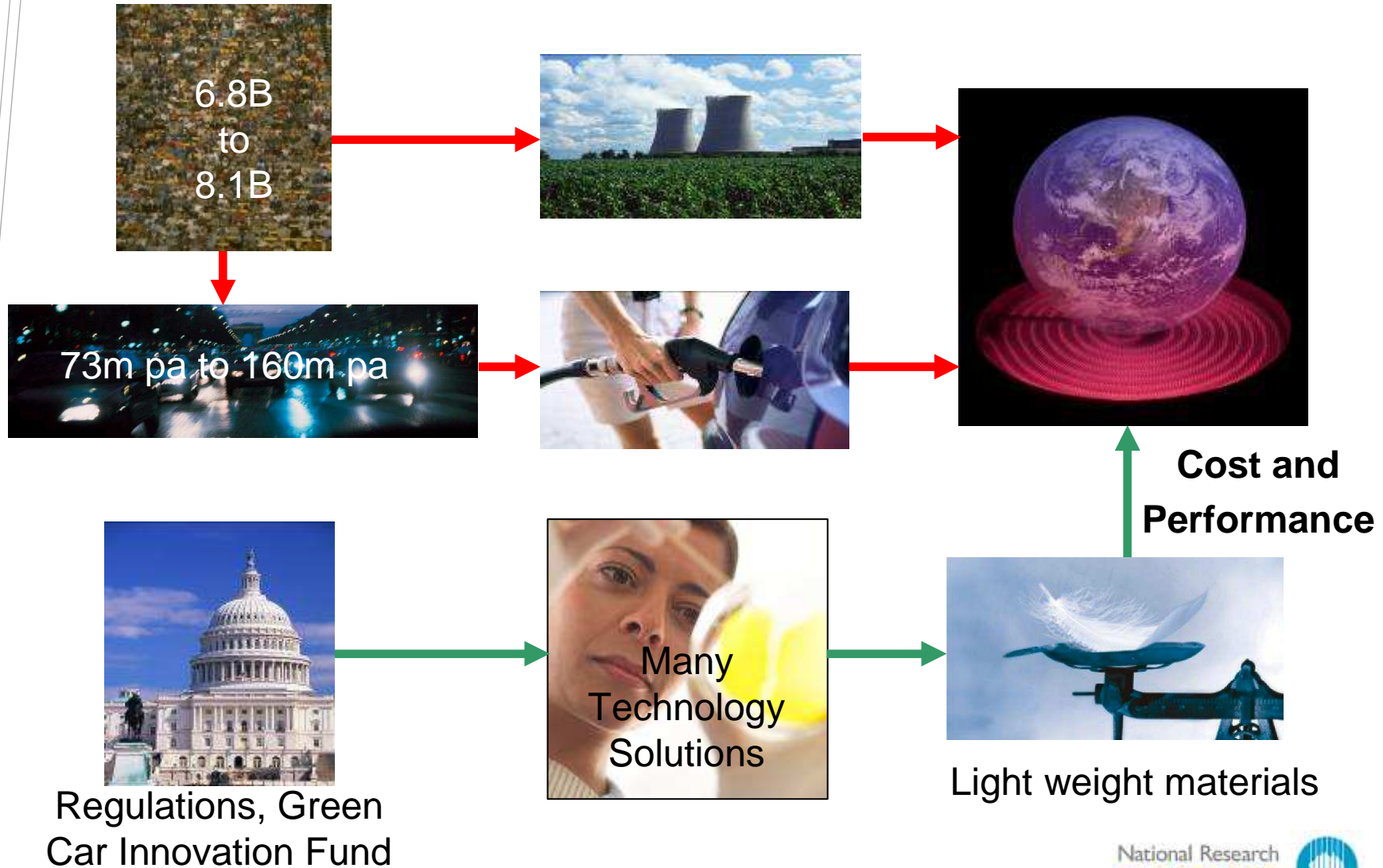
The Lightweighting Lowdown – SAE-A and AutoCRC
17 February 2011

Sam Tartaglia
CSIRO Light Metals Flagship

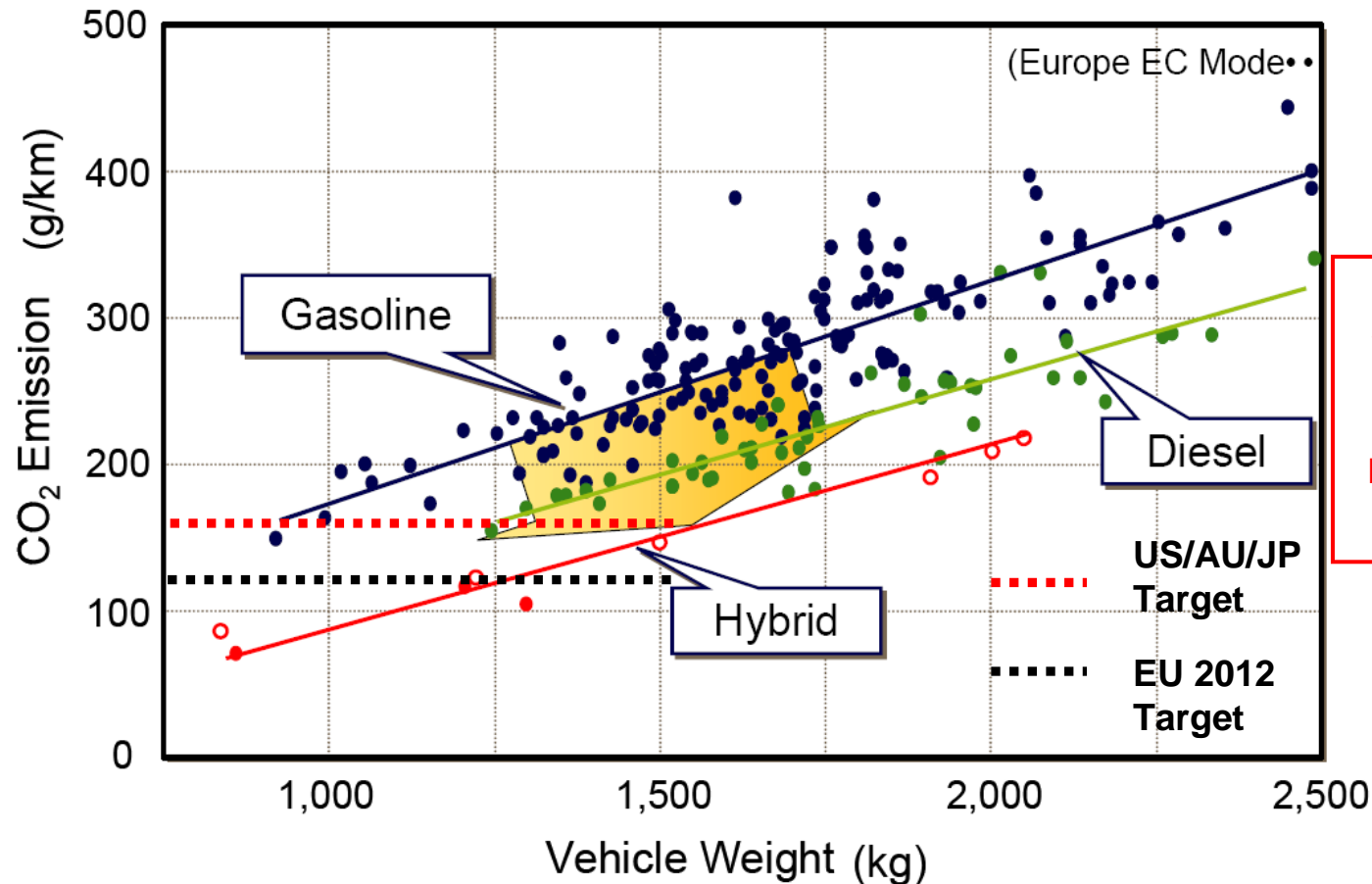
National Research
FLAGSHIPS
Light Metals



Why Lightweighting?



CO₂ Emissions vs Vehicle Weight



EU: 120g/km by 2012 (5L/100km);
China: 5.7L/100km by 2008,

US: 6.7L/100km by 2020
AU&JP: 6.7L/100km by 2010

Source: Masami Suzuki, "A Japanese Perspective on the Use of Aluminum Alloys in the Automotive Sector", International Conference on Aluminium Alloys, 2006

High Pressure Die Casting (HPDC) Heat Treatment

- Most widely used production method for aluminium automotive components
- Rapid and cost-effective
- HPDC alloys use recycled aluminium
- Components made by existing HPDC methods cannot be strengthened using heat treatment

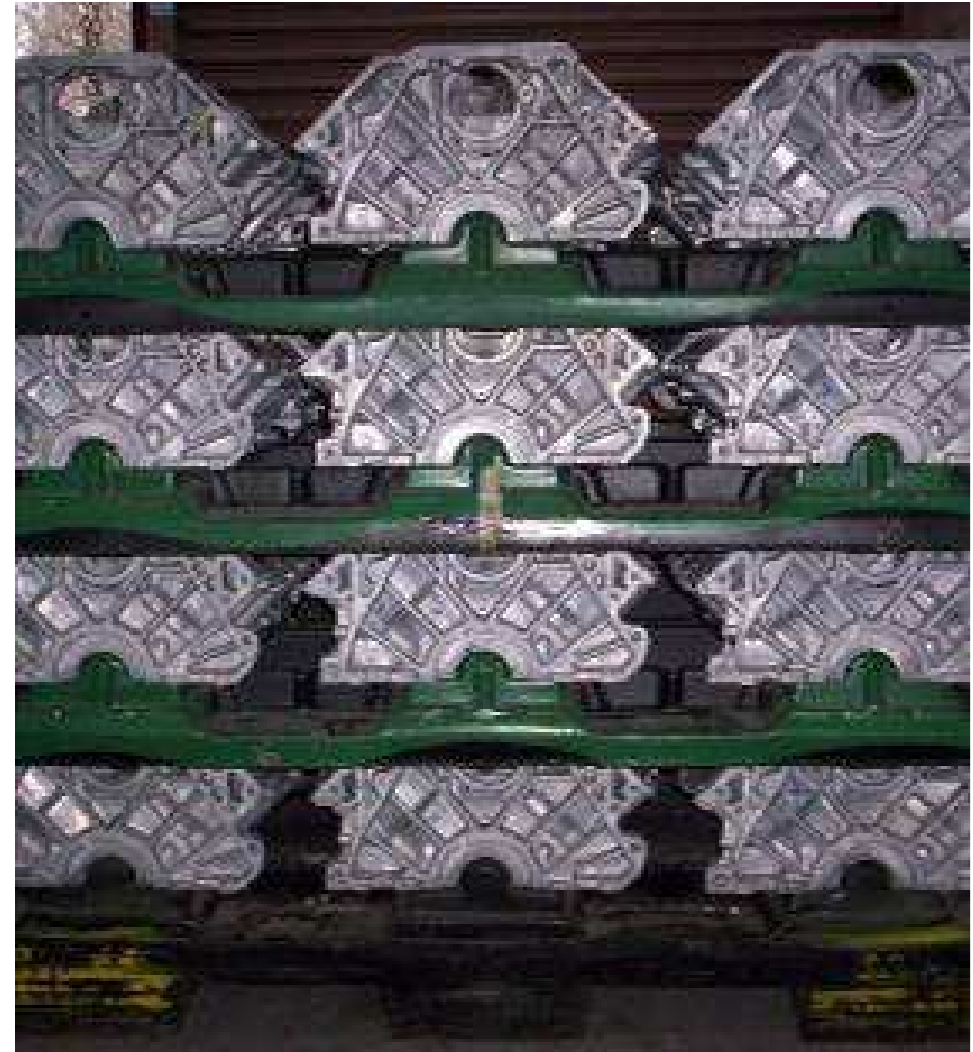


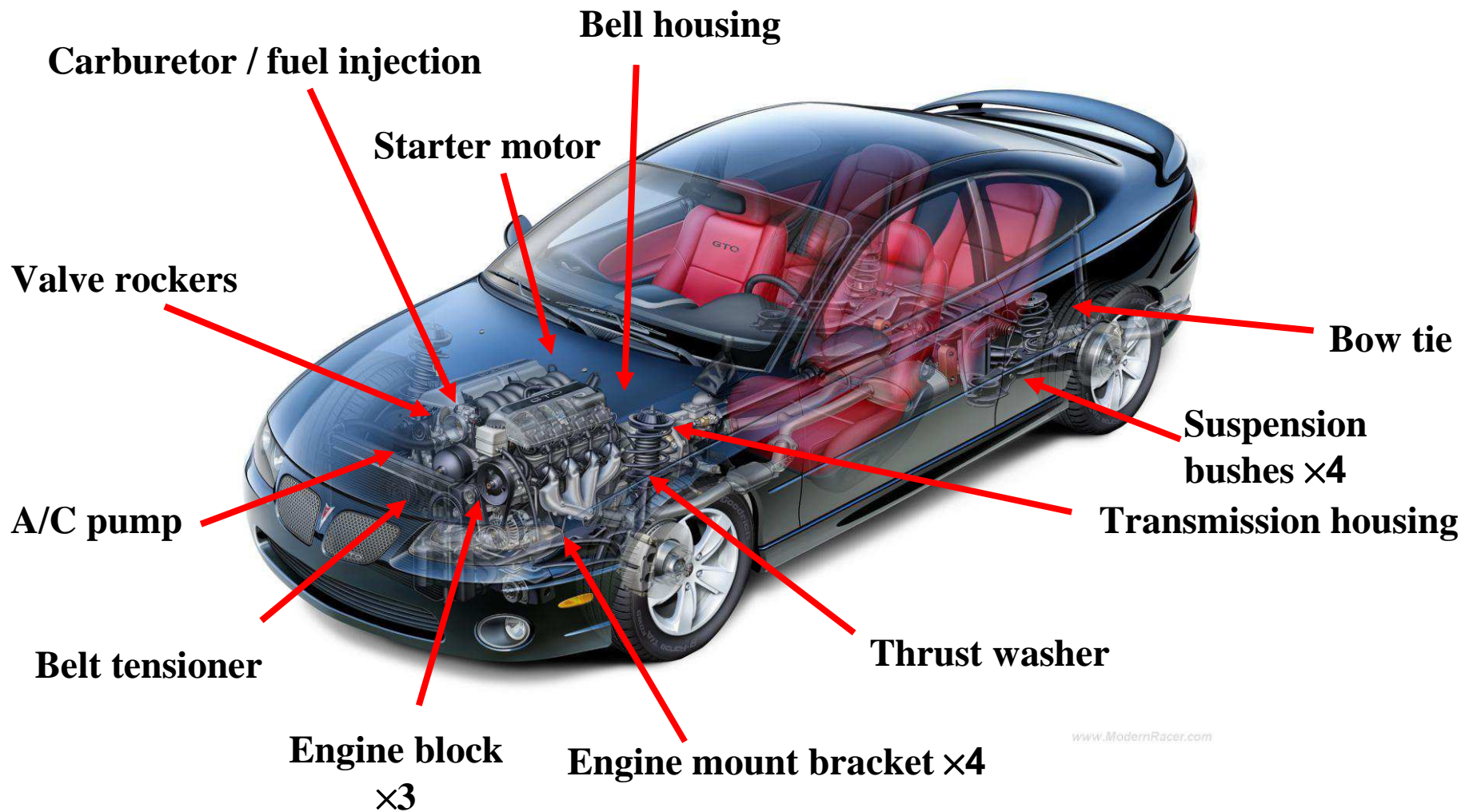
New heat treatment process for HPDC components

Allows car manufacturers to make strong, lightweight structural components

- Doubles mechanical strength
- Significantly increases fatigue resistance
- Significantly improves energy absorption and thermal conductivity

An enabling “Green Car” technology (lighter components = more fuel efficient cars)





NOT ACTUAL VEHICLE

HPDC Aluminium Wheels – the cost-saving opportunity

1. Reducing material purchased

- Improved casting yield from current low 60 – 70% to 80% or better, - Shot weight can be reduced, and less metal purchased and melted.

2. Use of cheaper secondary alloys suited to HPDC

- Secondary rather than primary grade (LPDC) alloys will be about 10% cheaper.

3. Reduced machining will save costs by:

- Shorter processing time and reduced number of machine tools.

4. Simpler and cheaper heat-treatment

- The proposed heat-treatment will be characterised by much shorter processing times, which it is believed will reduce the cost of this process by at least 30%.



Production by HPDC has estimated savings of **15–20%** per wheel

How big is this opportunity?

Europe, N. America and Japan 2008 production:

- 41 million cast wheels (34%).
 - Market value € 1.9 billion.
- 79 million steel rims (66%).
 - Market value €1.7 billion.

Steel rims dominate in number, but not value.

Note: data does not include important new markets e.g. China, India.



**This is a substantial opportunity –
A big market, projected to get bigger**

ATM High Pressure Die Casting



Benefits:

- **Improved material yield** – reduced waste
- Reduced projected area – **smaller machines**
- Lower die temperature – **longer tool life**
- **Lower porosity**
- Castings potentially **heat treatable & weldable**
- Observed **savings** in Al & Mg > **10%** vs conventional HPDC

Uses conventional melt & machine without additional capital cost

Recent licensees cite 4 month payback of investment in technology development.

Has been in production vehicles at GM Holden since 2004.

Magnesium Sheet by Continuous Casting

- Process for continuous Twin Roll Casting (TRC) of semi-finished magnesium alloy sheet
- Patented internationally
- Can deliver sheet down to 3.0 mm thick which can be rolled to 0.6mm
- Complemented by development of new magnesium alloys for high formability



Magnesium Sheet by Continuous Casting

Automotive Market

- Use of magnesium sheet in cars predicted to grow (2020 Vision Paper)
- USAMP partnership identifies CSIRO magnesium sheet technology as key for lightweight cars (body panels)
- RFQs issued by GM for two model variants of inner door skins



T-Mag Pty Ltd – joint venture spinoff

Objectives:

- Design and build a T-Mag casting machine with commercial production capacity
- Manufacture commercial automotive parts
- Create and sell technology package – machine, process and product know-how

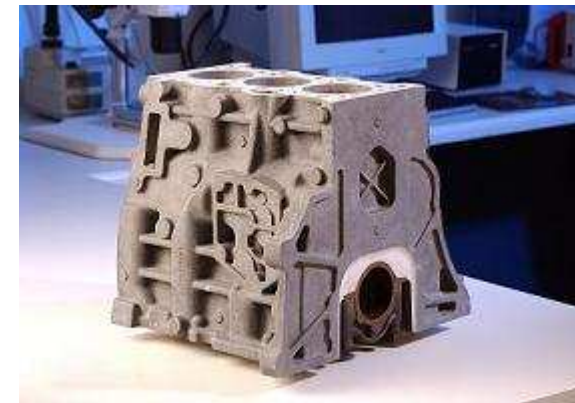
Outcomes:

- Machine completed and trialled
- Parts supplied to Harley Davidson and USCAR



Magnesium Alloys

- Major research with CAST CRC into the creep behaviour of Mg-RE alloys
- The content and species of the rare earth elements has a profound influence on the different stages of creep
- Current development of creep resistant magnesium alloys for high pressure die casting
- Major impact on world scene with USCAR and OEMs



Light Metals Technology

- Industrial Scale Research Facilities

- Tooling workshop
- Sand, gravity & low pressure casting
- Hot & cold chamber high pressure die casting
- Conform
- Twin Roll Casting
- Powder forming & sintering
- Hot, warm and cold rolling
- Hot & cold press forming
- Heat treatment
- Surface treatment
- Coatings & corrosion
- Evaluation & Testing
- High Temperature Controlled Atmosphere Treatments



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Thank you

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