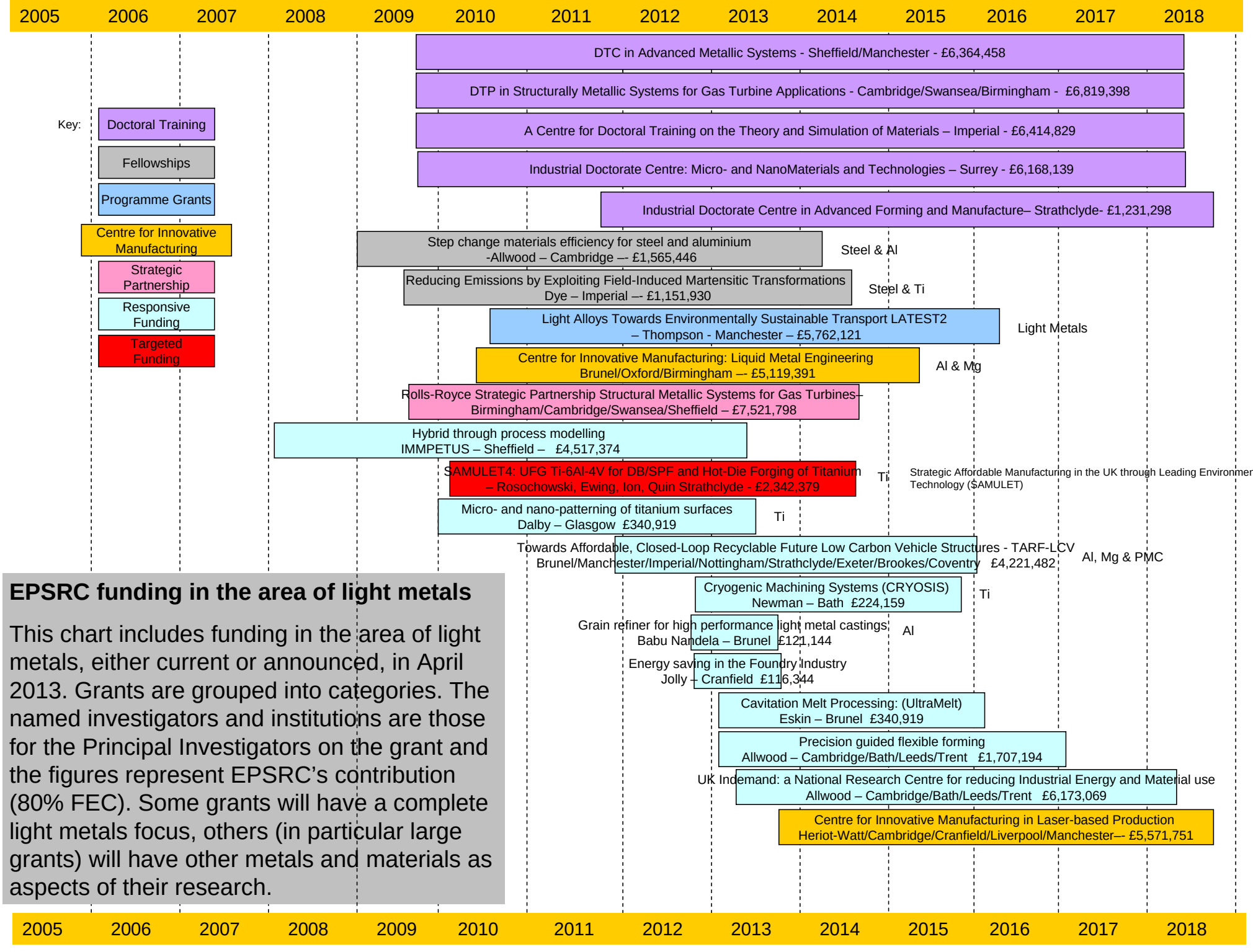
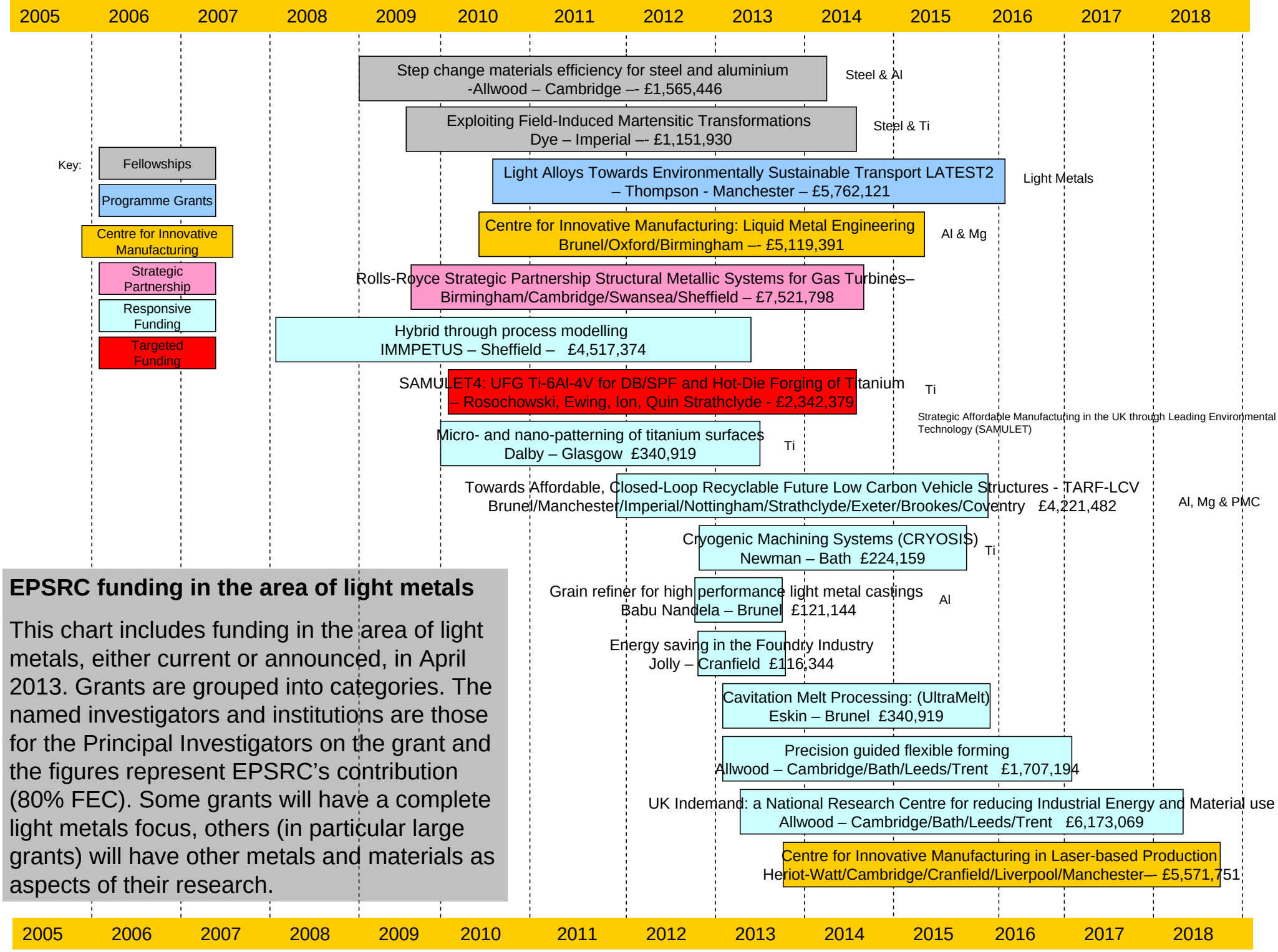
Overview of UK Research in Aluminium and Magnesium

Geoff Scamans
Innoval Technology and Brunel University



EPSRC funding in the area of light metals

This chart includes funding in the area of light metals, either current or announced, in April 2013. Grants are grouped into categories. The named investigators and institutions are those for the Principal Investigators on the grant and the figures represent EPSRC's contribution (80% FEC). Some grants will have a complete light metals focus, others (in particular large grants) will have other metals and materials as aspects of their research.



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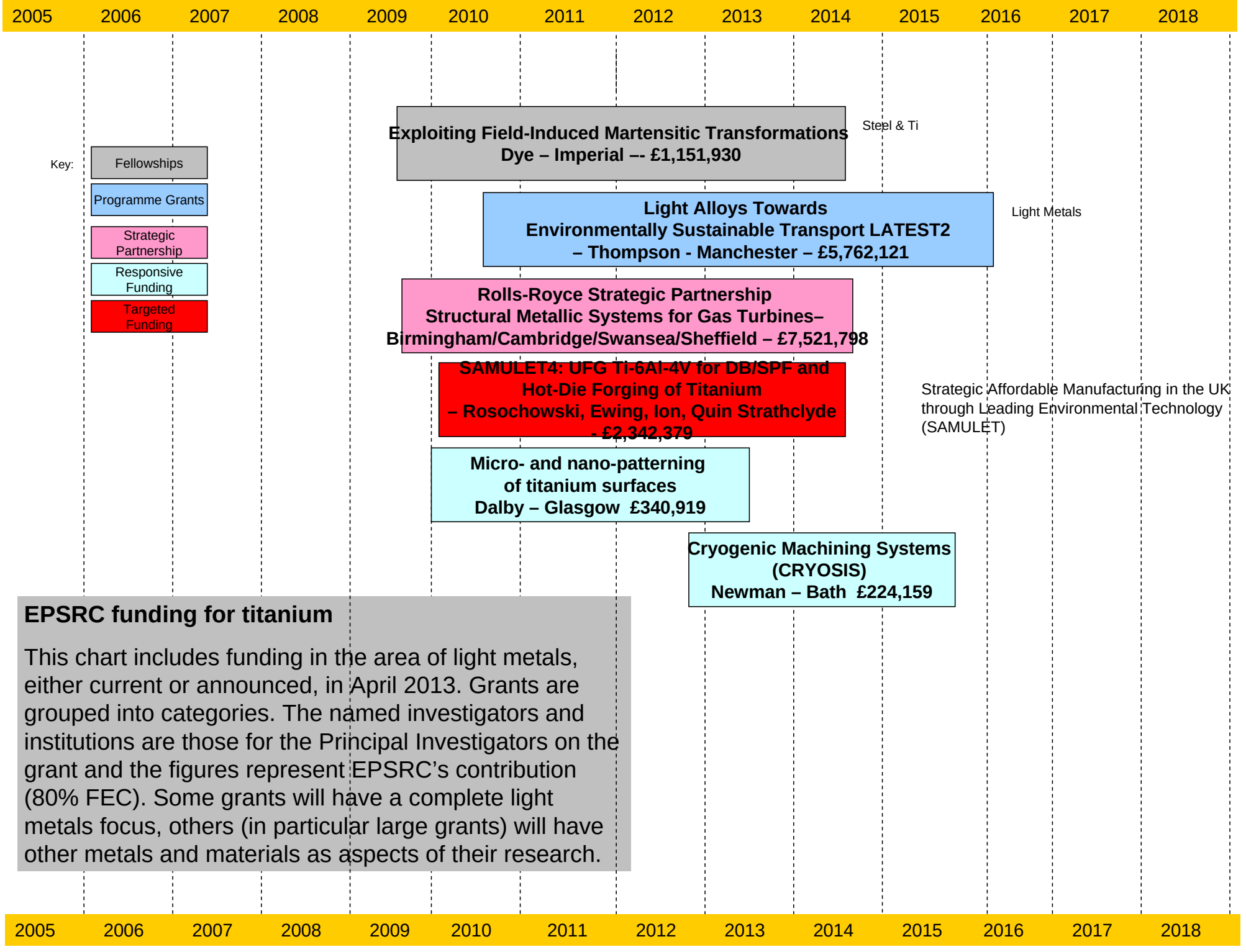
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Key:
Fellowships
Programme Grants
Strategic Partnership
Responsive Funding
Targeted Funding
Exploiting Field-Induced Martensitic Transformations
Dye – Imperial –- £1,151,930
Steel & Ti
Light Alloys Towards
Environmentally Sustainable Transport LATEST2
– Thompson - Manchester – £5,762,121
Light Metals
Rolls-Royce Strategic Partnership
Structural Metallic Systems for Gas Turbines–
Birmingham/Cambridge/Swansea/Sheffield – £7,521,798
SAMULET4: UFG Ti-6Al-4V for DB/SPF and
Hot-Die Forging of Titanium
– Rosochowski, Ewing, Ion, Quin Strathclyde
- £2,342,379
Strategic Affordable Manufacturing in the UK through Leading Environmental Technology (SAMULET)
Micro- and nano-patterning
of titanium surfaces
Dalby – Glasgow £340,919
Cryogenic Machining Systems
(CRYOSIS)
Newman – Bath £224,159
EPSRC funding for titanium
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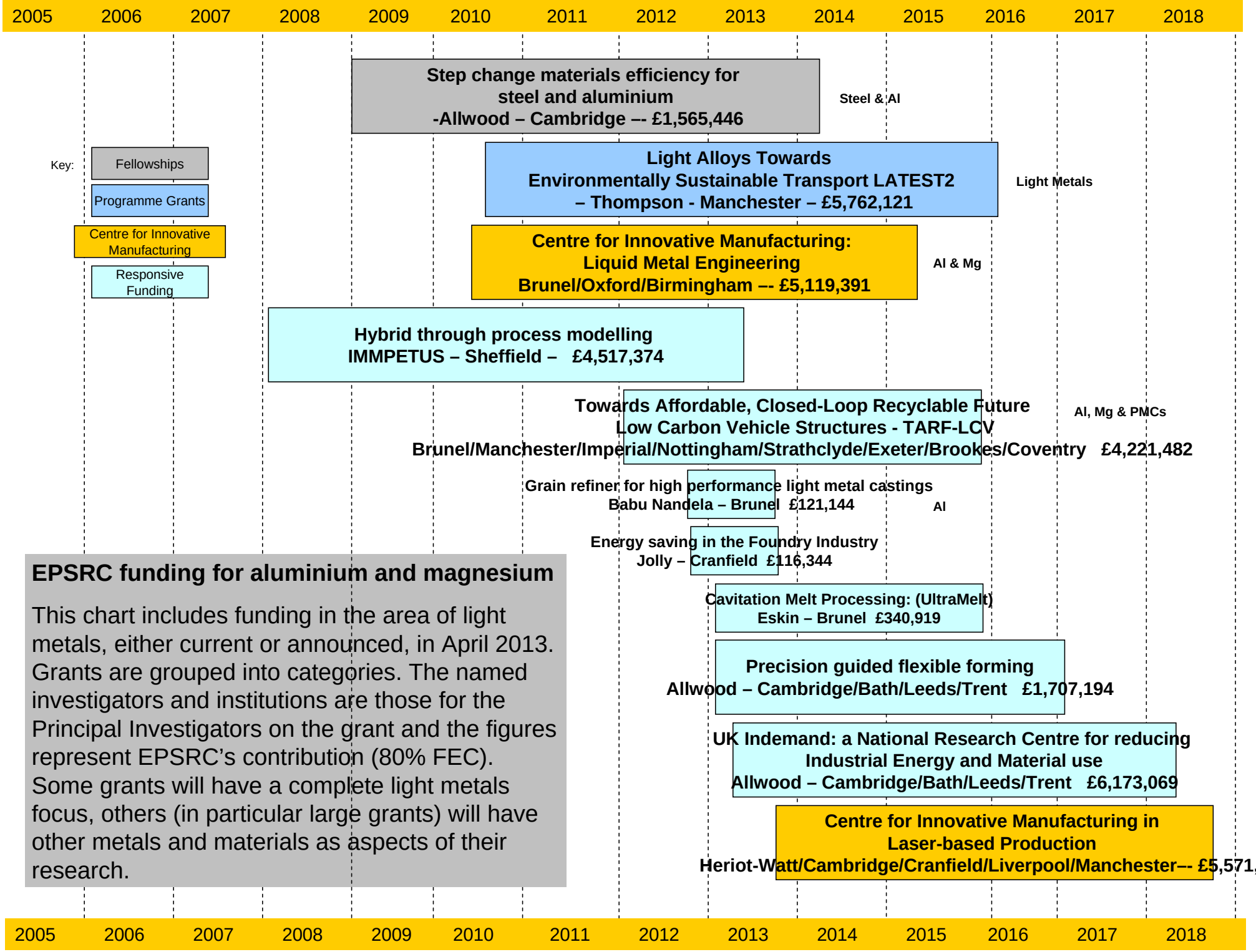

EPSRC funding for aluminium and magnesium

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Towards Affordable, Closed-Loop Recyclable Future Low Carbon Vehicle Structures: Metallic Materials Group Objectives

BCAST, Brunel University

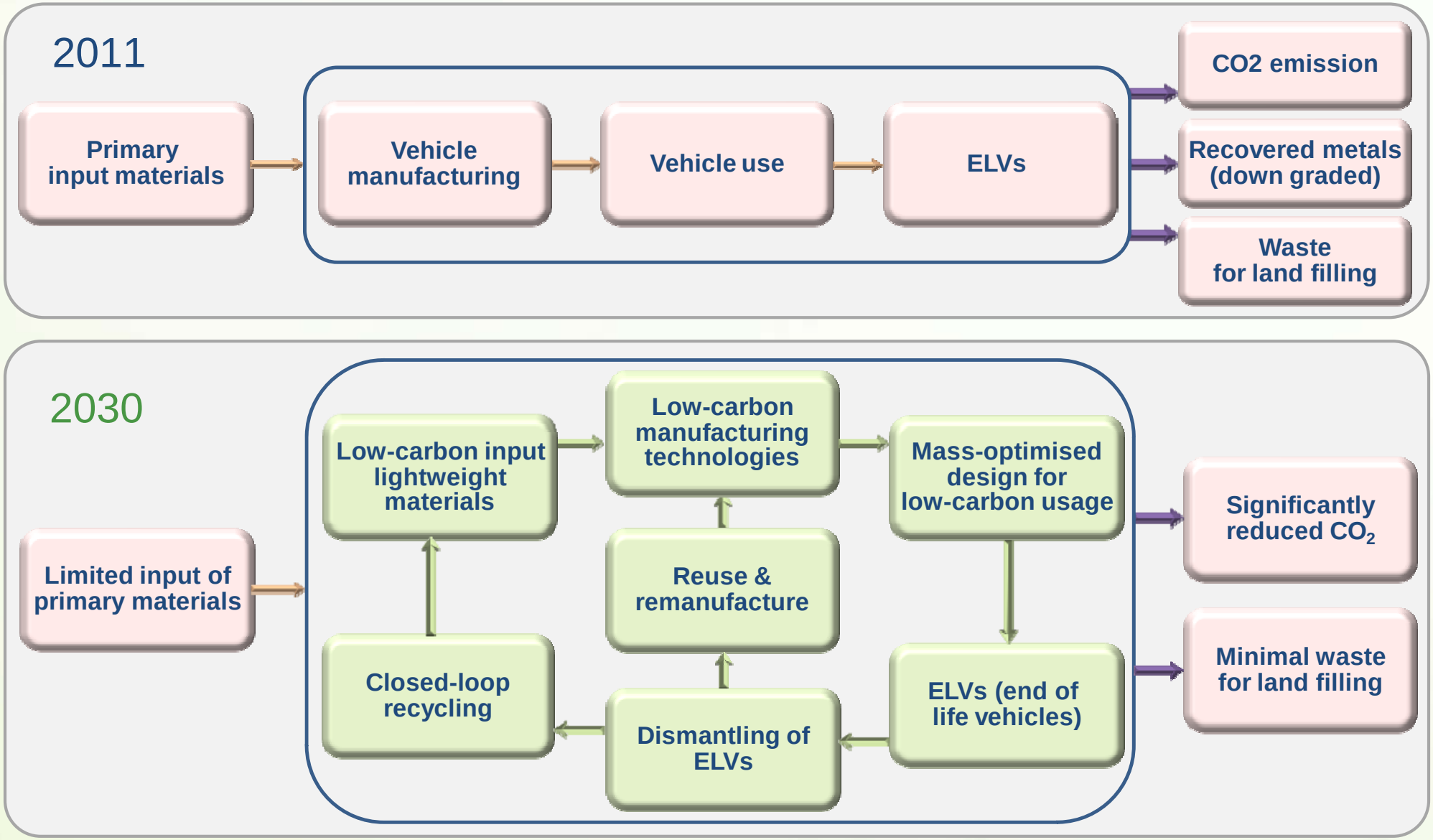
EPSRC

BCAST

Brunel UNIVERSITY LONDON

Research Vision and Ambition

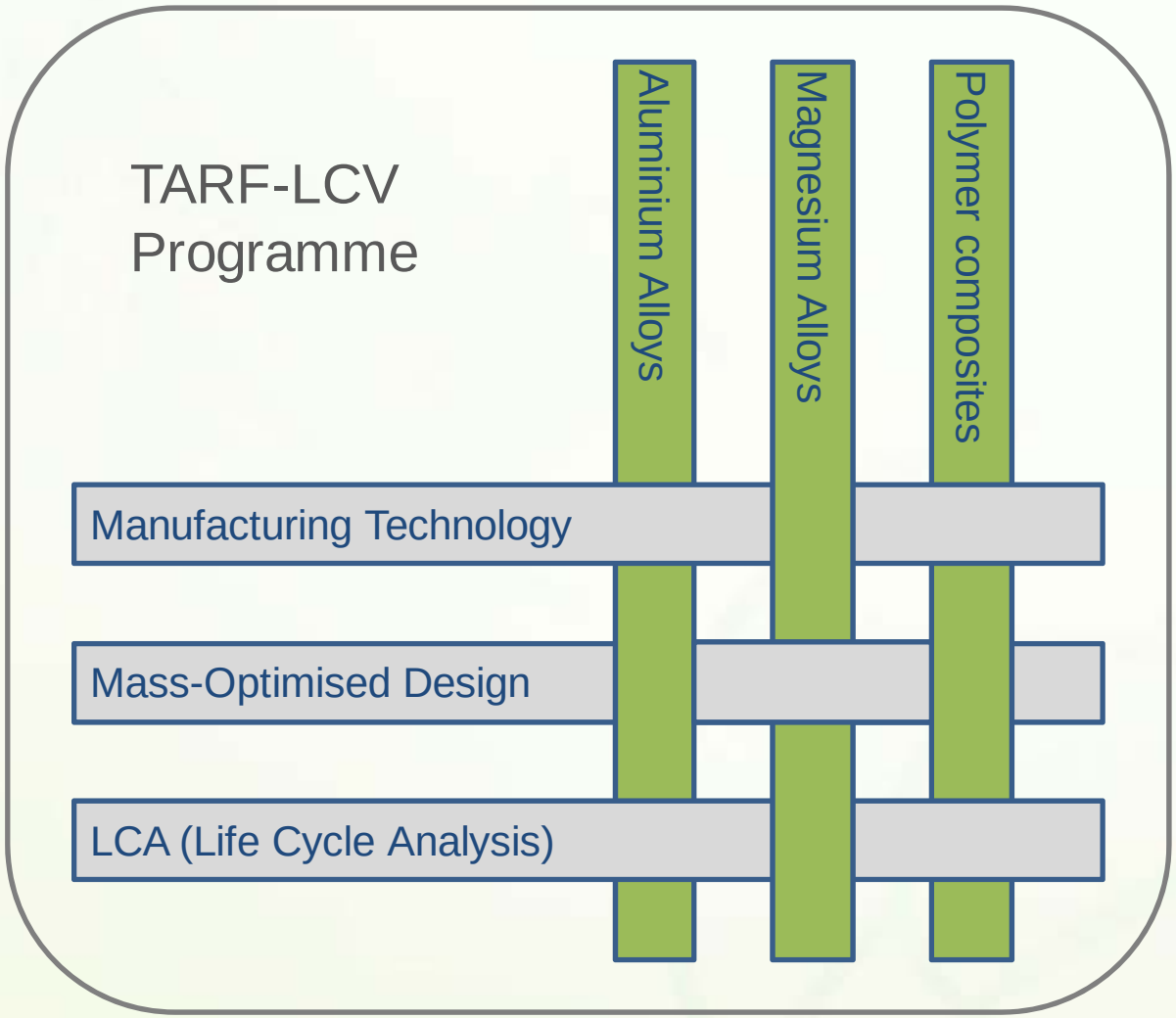
LiME
THE EPSRC CENTRE
FOR INNOVATIVE MANUFACTURING



Project Objectives

- To develop closed-loop recyclable Al-alloys and self-corrosion-resistant Mg-alloys
- To develop advanced PMCs using recyclable rGFs, rCFs and recoverable rNFs
- To develop novel technologies for liquid metal treatment to enable closed-loop recycling
- To develop advanced technologies for LC manufacturing and effective disassembly of ELVs
- To develop mass-optimised vehicle design principles
- To develop specific LCA methodology for future LCV development

Research programme



DTC in Advanced Metallic Systems - Sheffield/Manchester - £6,364,458

2011 Cohort projects and sponsoring companies
Advanced aluminium alloy 2139 for armour applications (DSTL, Constellium)
Processing and testing for the rapid discovery of new alloys (European Space Agency)
Characterising dental implant osseointegration: Surface modification and properties (Straumann)
Application of taper-rolling to the near-net shape production of aluminium wing skins (Siemens Metals Technologies)
Integration of computational materials engineering with aerospace structures (AMRC/Boeing)
Deformation mechanisms in nanostructured materials
Direct particle rolling of novel titanium alloy for the next generation of armour and defence applications (DSTL/Metalysis)
Microstructure Simulation and In-situ Measurement of ALM Processes

2010 Cohort projects and sponsoring companies
The development of aluminium foams with tailored mesostructure for enhanced heat transfer (Alcan)
Solid state processing of novel metastable beta titanium alloys (Metalysis)
Environmentally friendly novel coatings for aerospace alloys (Airbus)
Influence of rare earth alloying elements on the deformation mechanisms in magnesium sheet (Magnesium Elektron)
Development of material deposition strategies and lifting models for structural aerospace metallic components (Rolls-Royce)
Microstructure formability relationships in new generation high strength aluminium automotive alloys (Alcan)
The effect of macrozones on crack initiation and propogation in titanium alloys (Rolls-Royce)
Through-process microstructural modelling of rolled aluminium products - impact of recycling (Novelis)
Microstructure Process Maps for ALM Titanium Aerospace Components (EADS)

2009 Cohort projects and sponsoring companies
Probing metal oxide-electrolyte interfaces at the nanoscale: Enabling science for corrosion control
Controlling corrosion and hydrogen evolution in magnesium alloys for biomedical applications (Magnesium Elektron)
Evolution of near-surface deformed layers during fabrication of aluminium alloys (Innovaltec)
Assessment of the stationary shoulder FSW technique for producing T-joints (TWI)
Development of new alloys for next generation gas turbines (Rolls-Royce)

Industrial Doctorate Centre: Micro- and NanoMaterials and Technologies Surrey - £6,168,139

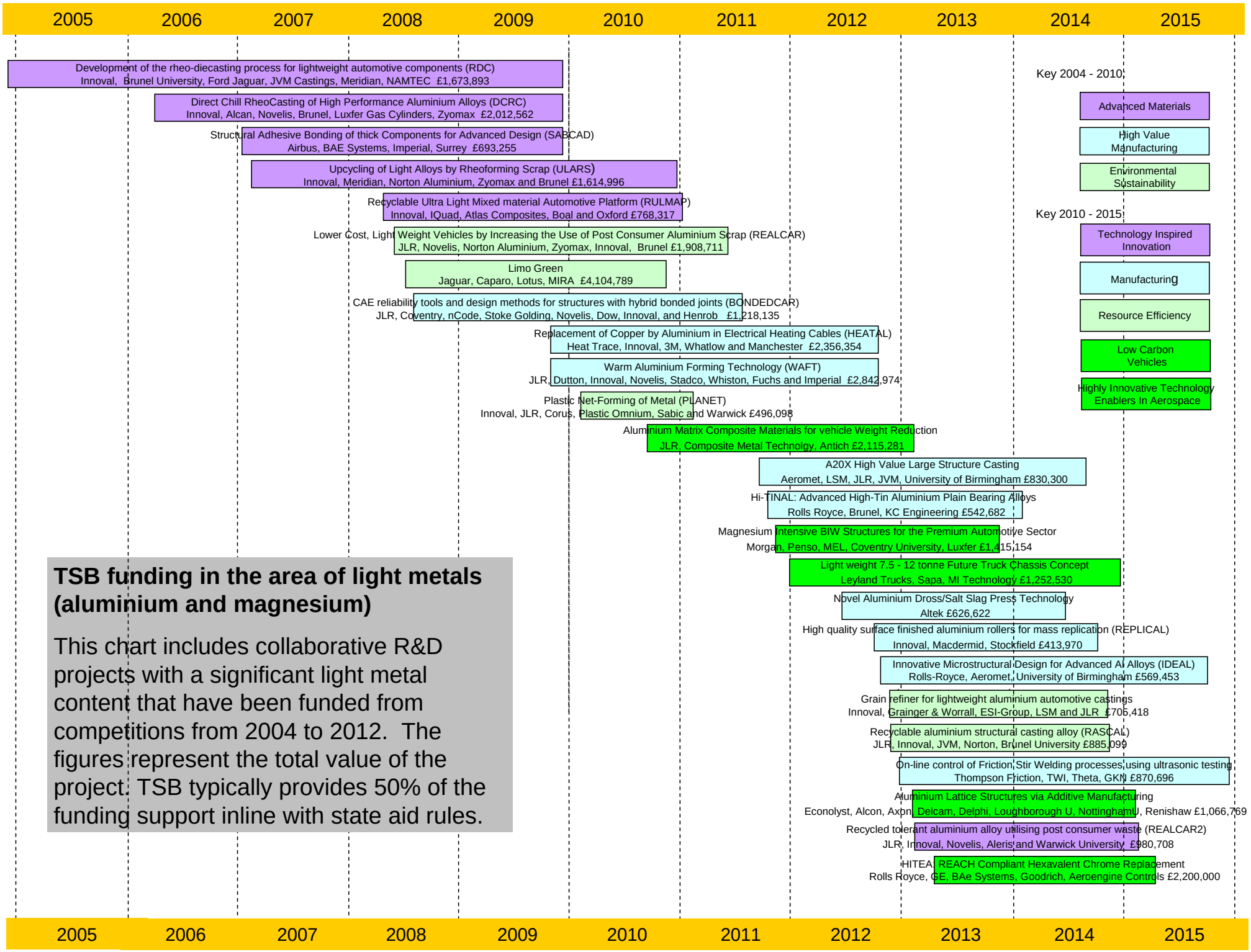
Titanium composite pressure vessel technology (TISICS)
Titanium composite manufacturing technology (TISICS)

Advanced damage tolerance composites for aerospace and defence applications (BAE Systems)
Advanced hybrid structures for aerospace/defence applications (BAE Systems)

Lightweight materials for vehicles (Lockheed Martin)

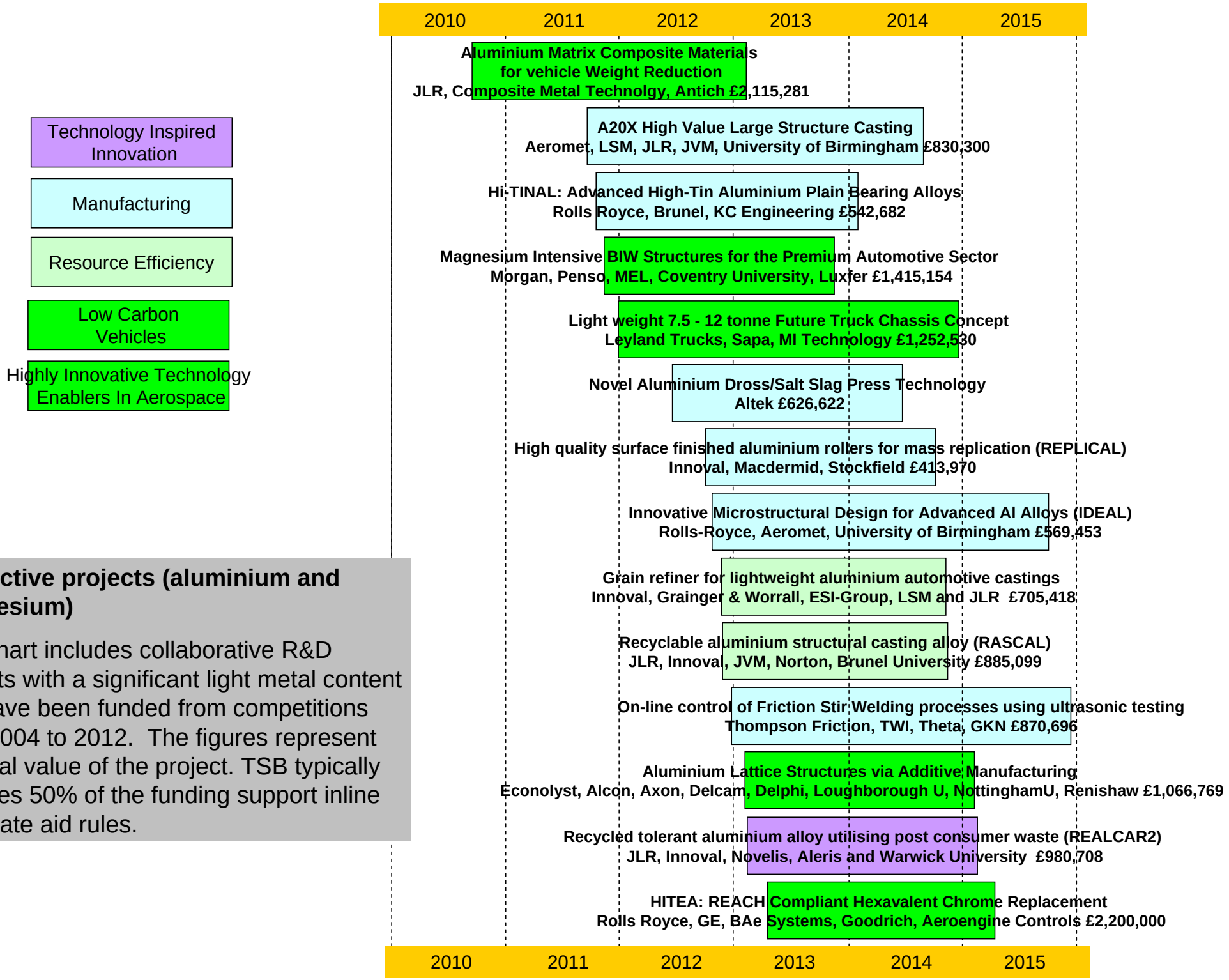
Industrial Doctorate Centre in Advanced Forming and Manufacture Strathclyde- £1,231,298

New Industry Projects for 2013:
Residual stress characterisation for hot-forged, quenched and machined aerospace structures
(Aubert & Duval, Rolls-Royce and AFRC)
Precipitation during forging and heat treatment of beta metastable Titanium Alloys for Aerospace Applications
(Aubert & Duval, Timet and AFRC)



TSB funding in the area of light metals (aluminium and magnesium)

This chart includes collaborative R&D projects with a significant light metal content that have been funded from competitions from 2004 to 2012. The figures represent the total value of the project. TSB typically provides 50% of the funding support inline with state aid rules.



TSB active projects (aluminium and magnesium)

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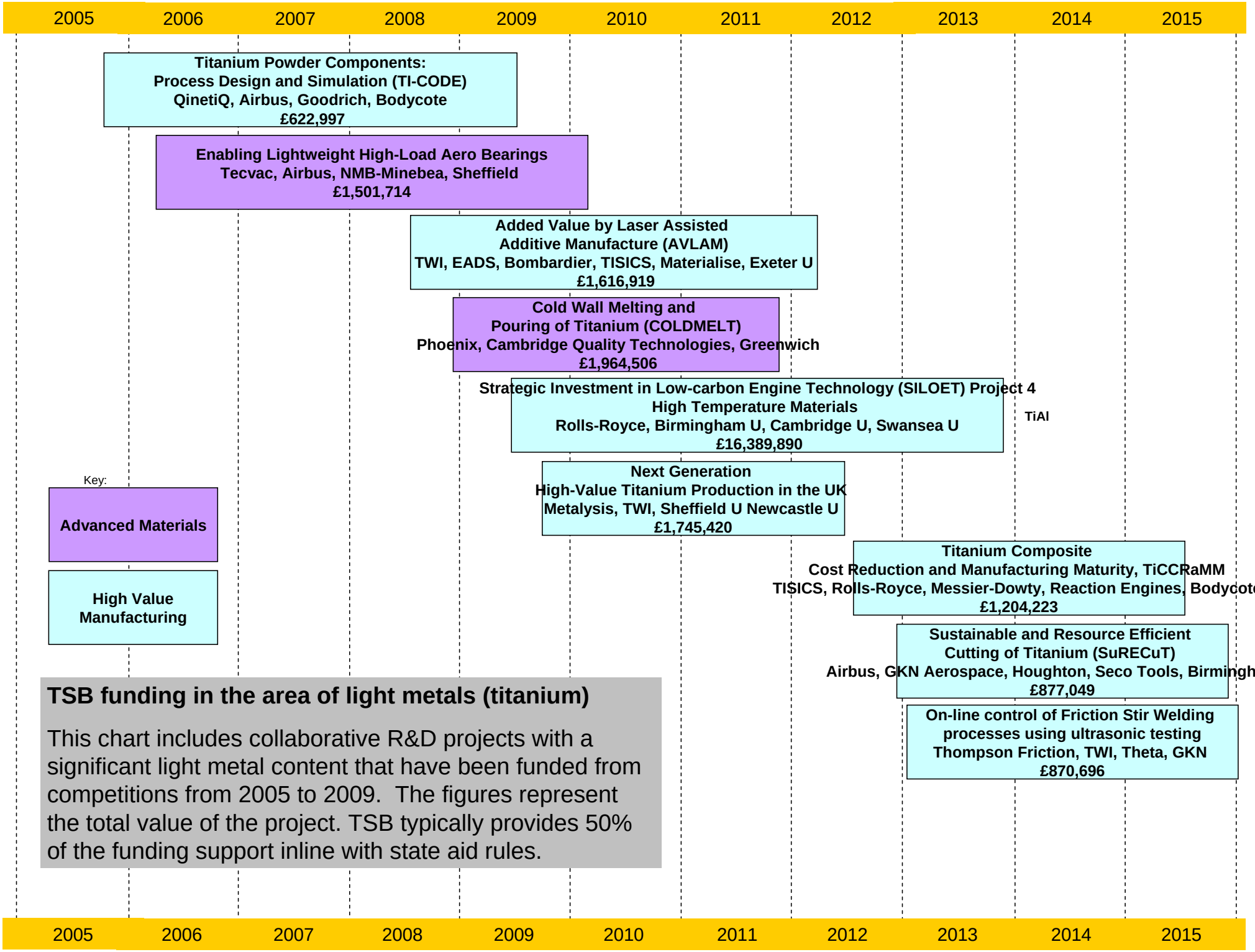
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Titanium Powder Components:
Process Design and Simulation (TI-CODE)
QinetiQ, Airbus, Goodrich, Bodycote
£622,997
Enabling Lightweight High-Load Aero Bearings
Tecvac, Airbus, NMB-Minebea, Sheffield
£1,501,714
Added Value by Laser Assisted
Additive Manufacture (AVLAM)
TWI, EADS, Bombardier, TISICS, Materialise, Exeter U
£1,616,919
Cold Wall Melting and
Pouring of Titanium (COLDMELT)
Phoenix, Cambridge Quality Technologies, Greenwich
£1,964,506
Strategic Investment in Low-carbon Engine Technology (SILOET) Project 4
High Temperature Materials
Rolls-Royce, Birmingham U, Cambridge U, Swansea U
£16,389,890
TiAl
Next Generation
High-Value Titanium Production in the UK
Metalysis, TWI, Sheffield U Newcastle U
£1,745,420
Titanium Composite
Cost Reduction and Manufacturing Maturity, TiCCRaMM
TISICS, Rolls-Royce, Messier-Dowty, Reaction Engines, Bodycote
£1,204,223
Sustainable and Resource Efficient
Cutting of Titanium (SuRECuT)
Airbus, GKN Aerospace, Houghton, Seco Tools, Birmingham
£877,049
On-line control of Friction Stir Welding
processes using ultrasonic testing
Thompson Friction, TWI, Theta, GKN
£870,696
Key:
Advanced Materials
High Value
Manufacturing
TSB funding in the area of light metals (titanium)
This chart includes collaborative R&D projects with a significant light metal content that have been funded from competitions from 2005 to 2009. The figures represent the total value of the project. TSB typically provides 50% of the funding support inline with state aid rules.
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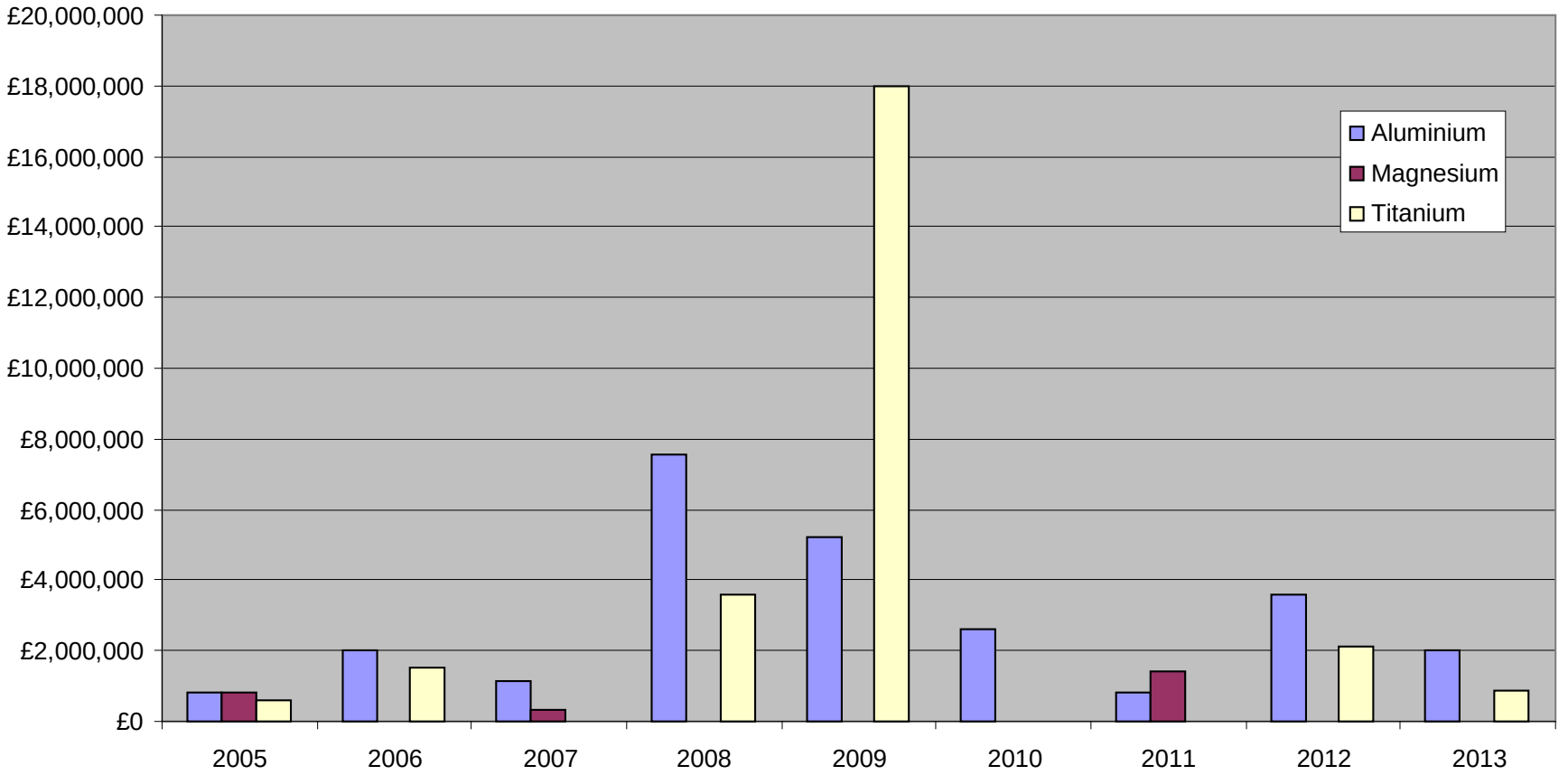
Light Metal TSB Project Value by Year (2005 to 2013)



Total project value for Aluminium is £25.8m, Magnesium £2.6m and Titanium £26.7m

Summary

- EPSRC support for aluminium and magnesium is concentrated within LiME, LATEST2, TARF-LCV and WellMet. These programmes support a large number of RAs and PhDs
- The Advanced Metallics DTC supports a large number of aluminium and magnesium PhD projects
- The support for magnesium research is relatively small compared with aluminium (and titanium)
- TSB funding has supported about 25 aluminium and magnesium and 9 titanium projects to date with a total project value of over £50m
- Most of the support is for automotive and aerospace related applications