

Future need of advanced manufacturing research infrastructures

*High Value Manufacturing
Catapult
(A Technology and Innovation Programme)*

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Advanced Manufacturing Infrastructures

A Compelling Need

Sustainable Economic Growth

- Shared and resilient over the long term

Manufacturing of the future

- High Value and Environmentally Sustainable
- Addressing Societal Changes
- Investing in Industries

Route to Success

- Reputation for innovation and research
- Hauser and Dyson reports

Government Commitment

- A network of Technology and Innovation Centres
- Sustained long-term funding



The Catapults

One Single Shared Goal

Cell Therapy

- *Development of Specialised and personalised medicines*

Offshore Renewable Energy

technologies applicable to offshore wind, tidal and wave power

Satellite Applications

- *centres and facilities for satellite data processing and product development.*

Digital Connected Economy

developing and launching digitally-enabled systems, services and products.

Transport Systems

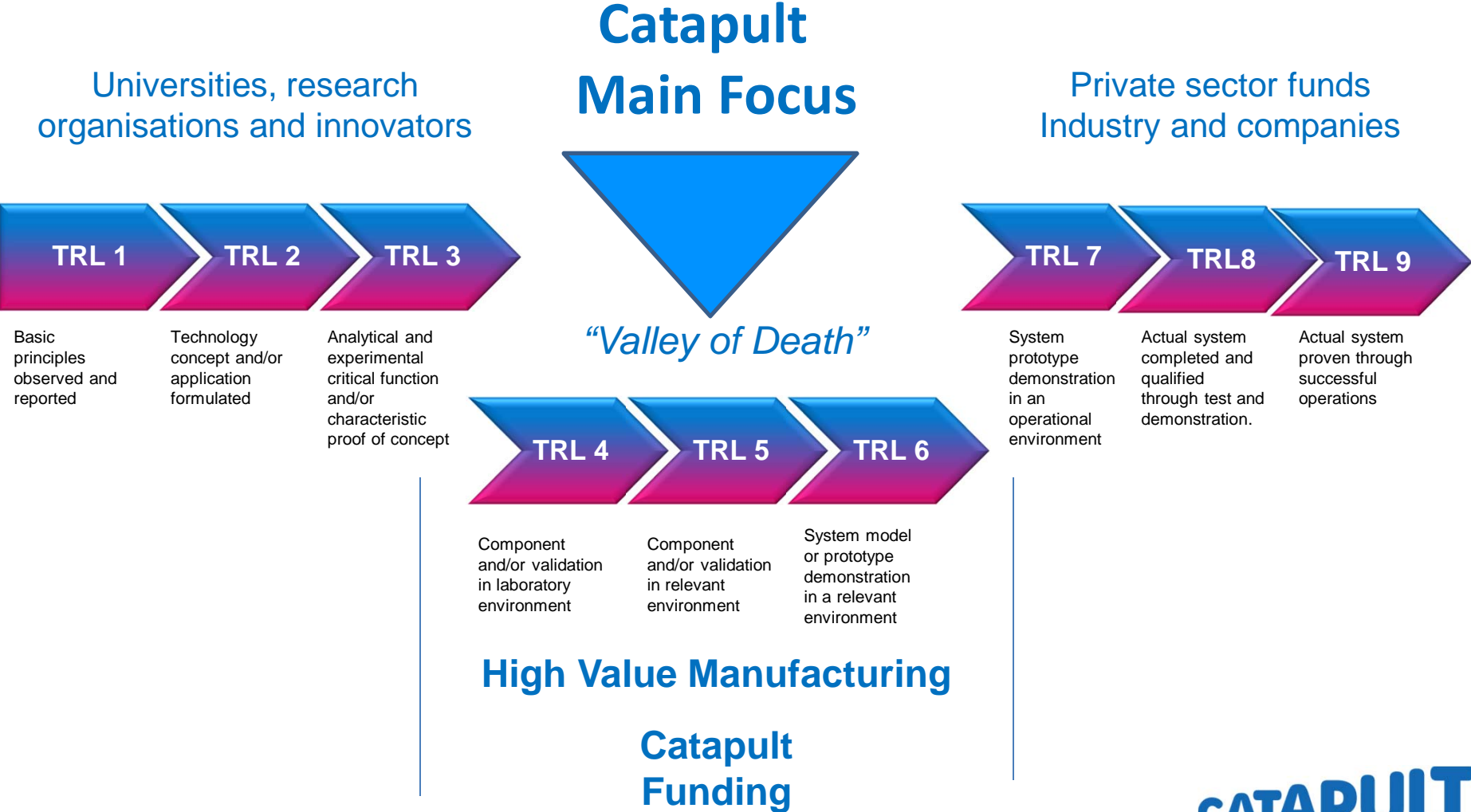
transport modelling for development of wholly new systems and approaches

Future Cities

- *smart systems for health, energy, water, waste, communications and buildings*

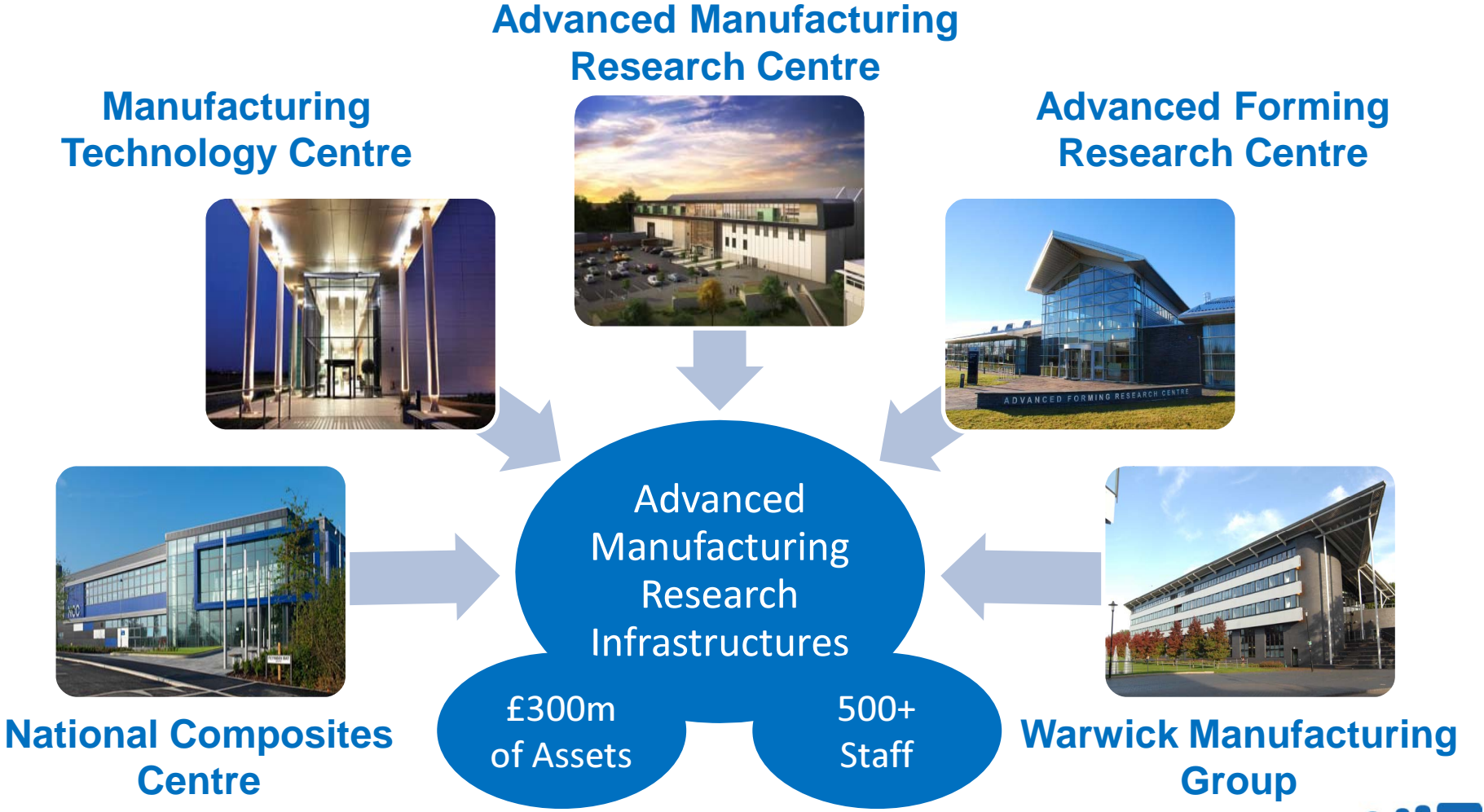
And > **High Value Manufacturing**

The Catapults Commercialising Innovation



High Value Manufacturing Catapult

5 Centres - leading edge Aerospace R&D



High Value Manufacturing Catapult 5 Centres – Delivering for Aerospace

Lowering Risk

- Investment risk reduced through collaboration with HVM Catapult

Enabling Access to Cutting-edge Equipment

- Normally inaccessible to many individual companies

Creative Cross Sector Collaboration

- Joint projects with leading-edge research partners

Influencing Core Research

- Stakeholders able to input to areas of core research

Supply Chain Partnership

- Large companies and SMEs can come together in partnership

Skills Development at All Levels

- A hub for learning at the heart of the action

High Value Manufacturing Catapult

How are Centres funded?

The Funding model draws equally from three sources:

Core Public Funding

- for investment in the capabilities, know how, expertise and skills and Long term capital assets of the centre.

Business Funded

- R&D contracts (i.e. contract research) won competitively

Joint Public-Private

- Collaborative (applied) R&D projects funded jointly by the public and private sector, won competitively from UK and EU calls

All supported by a 5 year business plan

High Value Manufacturing Catapult Core Aerospace Technologies

AFRC – Glasgow	AMRC - Sheffield	MTC - Coventry	WMG - Warwick	NCC - Bristol
<p>Production Process Optimisation Repeatability and productivity Material/ & Energy Reduction Process monitoring/Ctrl Modelling & Simulation</p> <p>Component Quality & Integrity Advanced systems Customised component performance Material measurement and characterisation</p> <p>Nearer net shape forming processes Novel and established forming processes</p>	<p>Hi Performance Machining Rapid material removal</p> <p>Advanced Structural Testing Materials and components</p> <p>Process Simulation Virtual modelling</p> <p>Assembly of Hybrid & Metallic Composites</p>	<p>3D Modelling and Simulation Virtual reality process try-out and factory planning</p> <p>Advanced Tooling and Fixturing Precision assembly of large structures</p> <p>Rapid Accurate Material Deposition Complex geometries and high volume</p> <p>Net Shape and Additive Manufacture Joining and Welding (Laser, Friction, TIG)</p> <p>Hi Integrity Electronic Systems</p>	<p>Design for Manufacture Cost, reliability and robustness</p> <p>Low Carbon Mobility Lightweight product / system optimisation Lightweight components and structures</p> <p>Energy Storage and Management Precision</p> <p>Digital Verification</p>	<p>Advanced 3D Modelling and Analysis Integrated design and manufacturing capability</p> <p>Rapid Accurate Material Deposition Complex geometries and architectures Composites in volume</p> <p>Next Generation Structures Aerospace / Marine / Offshore renewables</p> <p>Process Optimisation</p> <p>Phase II New facilities and twice the space</p>

Advanced Forming Research Centre

Case Study: Rolls-Royce

Compressor Aerofoil Die Life

- Study of hot forging process
- Development of physics-based die life prediction model
- Knowledge applied to in-plant improvement programmes
- Improvements led to doubling of die life
- Reduced manufacturing cost and increased capacity
- Benefits integrated in the process at Rolls-Royce's Compressor Facility in Glasgow

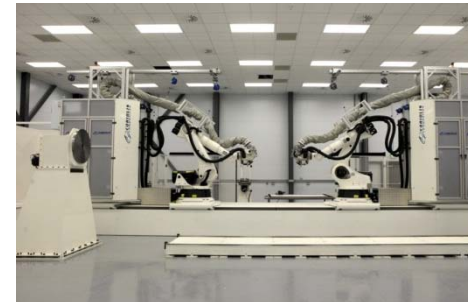


National Composites Centre

Case Study: Airbus / GKN

Next Generation Composite Wing: Auto Fibre Placement

- Airbus led 3 years involving 17 partners
- Developing future wing concepts and associated supply chain capability
- Large involvement of Prime: T1's, SME's, Material & Tooling providers, Process Equipment Manufacturers
- Given opportunity to rapidly create complex, double curved structures in composite materials. Result suggest structures could be 20% lighter with 75% reduction in material waste



Warwick Manufacturing Group

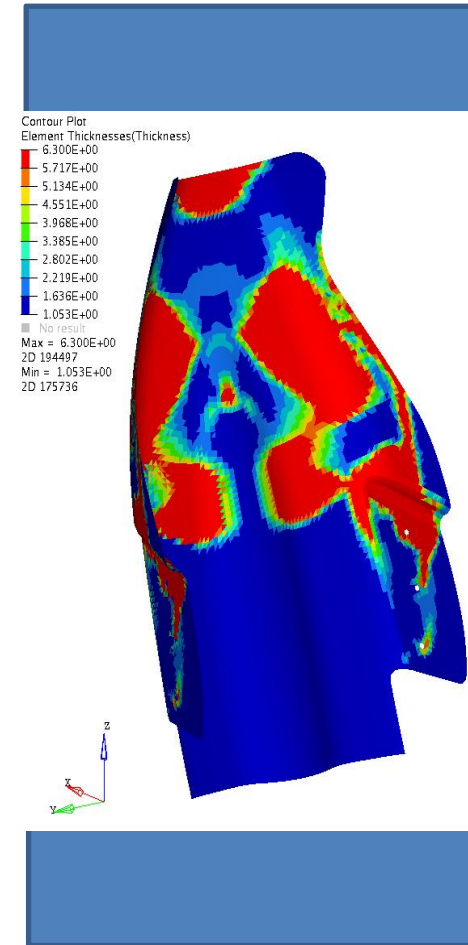
Case Studies: Confidential

Light Weight Seat Back at Reduced Environmental Impact

- Material evaluation and characterisation
- Performance simulation and analysis
- Technical verification prototype validation
- Confirmation for performance to Federal standards
- Production material and process selection

Results

- Weight saving confirmed approaching 50%
- Fully recyclable material technology
- High performance thermoplastic composite laminate
- Rapid stamp forming process < 90s



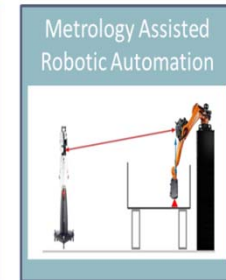
Manufacturing Technology Centre

Case Study: LOCOMACHS Partner – SAAB Led

SAAB Led Programme with 31 Partners

Work Package 32

- Developing automated processes and process tools to enable ‘one way assembly’ of the aero-structure selected for the MiWiB & LAWiB demonstrator.



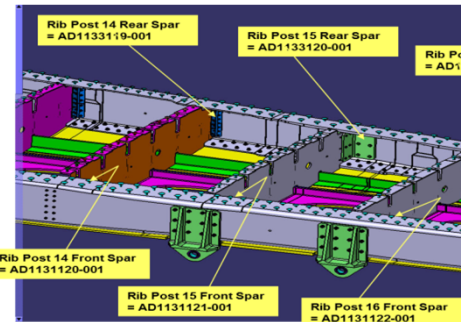
Work Package 34

- New solutions for assembly tooling to support active fixturing to assist drilling and fastening process during the skin to structure assembly for the MiWiB & LAWiB demonstrators.



Work Package 45

- In 2015 MTC will play host to the final MIWiB and LAWiB Demonstrators.

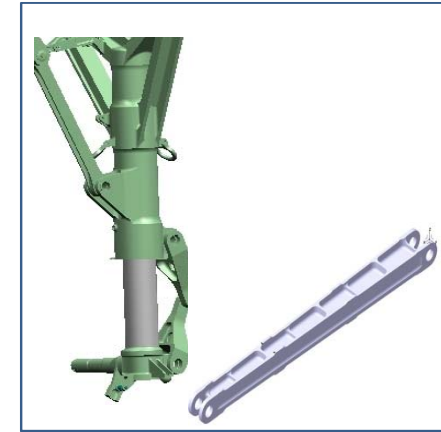


Advanced Manufacturing Research Centre

Case Studies: Messier–Dowty and Rolls-Royce

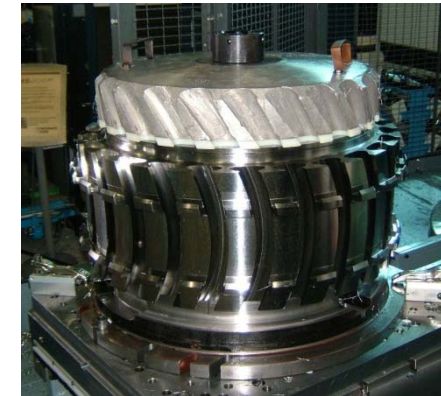
Titanium Side Tray (Messier-Dowty)

- Simple prismatic part similar to Boeing design
- New Material Ti-5553
- Study in specific machining time to develop cost of Ti parts on 787 gear
- Incorporating representative DFM features
- Original time 54 hrs, Target 27 hrs, Achieved 11 hrs



High Performance Disk Machining (Rolls-Royce)

- Slot machining of the fan disk
- Stepped change in work content and quality
- Re-investment in new facilities in NE UK



Advanced Manufacturing Research Centre



High Value Manufacturing Catapult Delivering

Accelerating Technology Commercialisation

- skills and equipment helping businesses large and small give commercial life to great ideas.

Cross Sector Capability

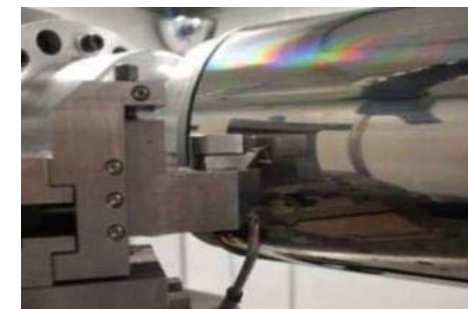
- Industries working together to a common goal
- New technologies shared across industries

Fostering innovation

- Helping to rebalance the economy

.....the Results.....

- Rolls-Royce Advanced Blade Casting Facility
 - Sandwell UK Specialised Shot-peening
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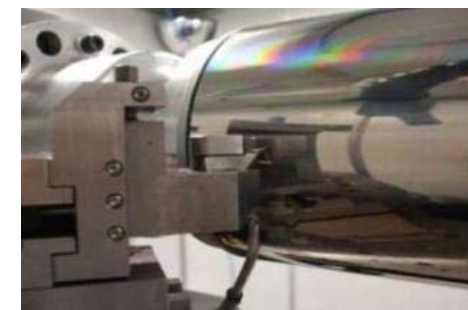


High Value Manufacturing Catapult

And finally.....

The HVM Catapult

- is the catalyst for the future of manufacturing
- is a long term programme for innovation
- will continue to support key industries such as Aerospace and Automotive and grow others
- will provide SMEs with access to skills and technology and collaboration partners
- will strengthen the UK thereby strengthen Europe's competitiveness in Global Markets
- will be at Aerodays 2015 Conference and Exhibition, but you're welcome anytime

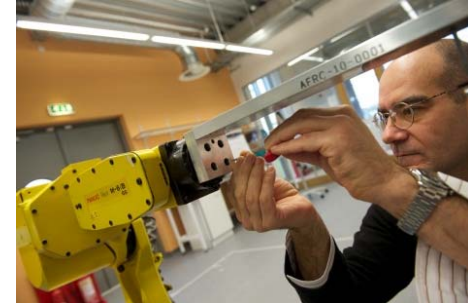


Future need of advanced manufacturing research
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Advanced Forming Research Centre Core Competencies

- **Production Process Optimisation**
 - Repeatability and productivity
 - Material waste and Energy reduction
 - In process monitoring and control
 - Modelling & Simulation
- **Component Quality and Integrity**
 - Application of advanced systems
 - Customised component performance
 - Material measurement and characterisation
- **Nearer net shape forming processes**
 - Optimising novel and established forming processes



National Composites Centre Core Competencies

Advanced 3D Modelling and Analysis

- Integrated design and manufacturing capability

Rapid Accurate Material Deposition

- Complex geometries and architectures
- Composites in volume

Next Generation Structures

- Aerospace / Marine / Offshore renewables

Process Optimisation



Warwick Manufacturing Group Core Competencies

Design for Manufacturing

- Cost, reliability and robustness

Low Carbon Mobility

- Lightweight product / system optimisation
- Lightweight components and structures

Energy Storage and Management

- Precision

Digital Verification



Manufacturing Technology Centre Core Competencies

Modelling and Simulation

- Virtual reality process try-out and factory planning

Advanced Tooling and Fixturing

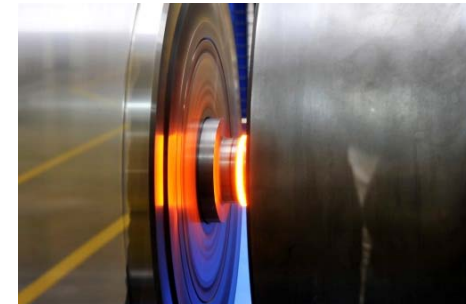
- Precision assembly of large structures

Intelligent Automation

Net Shape and Additive Manufacture

Hi Integrity Electronic Systems

- Joining and Welding (Laser, Friction, TIG)



Advanced Manufacturing Research Centre Core Competencies

Hi Performance Machining

- Rapid material removal

Advanced Structural Testing

- Materials and components

Process Simulation

- Virtual modelling

Assembly of Hybrid and Metallic Composites



Advanced Manufacturing Research Centre



HEXAGON
METROLOGY



Rolls-Royce

