

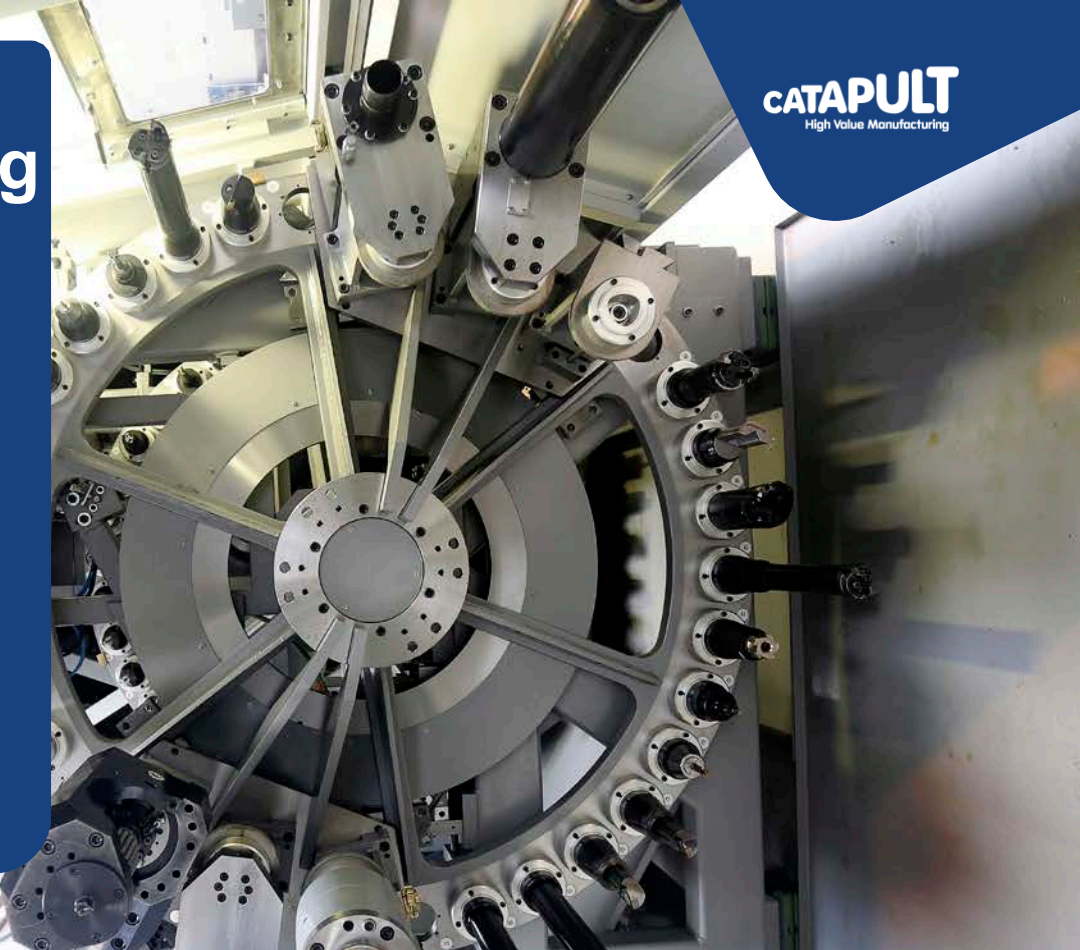
# High Value Manufacturing Catapult

**Dr Daniel Thompson**

Senior Technology Officer @ National Composites Centre

HVM Catapult Presentation

11 February 2016



# UK Manufacturing – the Facts

- ▶ The global manufacturing market is worth **£6.7** trillion
- ▶ Manufacturing makes up **10.5%** of UK's GDP
- ▶ **54%** of the UK's exports come from manufacturing
- ▶ Manufacturing accounts for **2.5 million+** UK jobs
- ▶ **72%** of UK R&D is funded by the manufacturing industry





- ▶ Average starting salary for UK engineering graduates **>10%** higher than other graduates
- ▶ UK ranks **15** in the global manufacturing competitiveness index
- ▶ UK manufacturing productivity up by **40%+** in the last decade
- ▶ UK is the world's **2nd** largest aerospace manufacturer
- ▶ **2/3** of UK manufacturing companies are investing in reducing their carbon footprint



# The Catapults

- Network of technology and innovation centres
- Focus on areas where UK has inherent strengths and where market potential is significant.
- Bringing the best of the UK's innovative businesses and researchers together to bring new products and services more quickly to commercialisation.

**cATAPULT**  
High Value Manufacturing

**cATAPULT**  
Cell Therapy

**cATAPULT**  
Connected Digital Economy

**cATAPULT**  
Future Cities

**cATAPULT**  
Offshore Renewable Energy

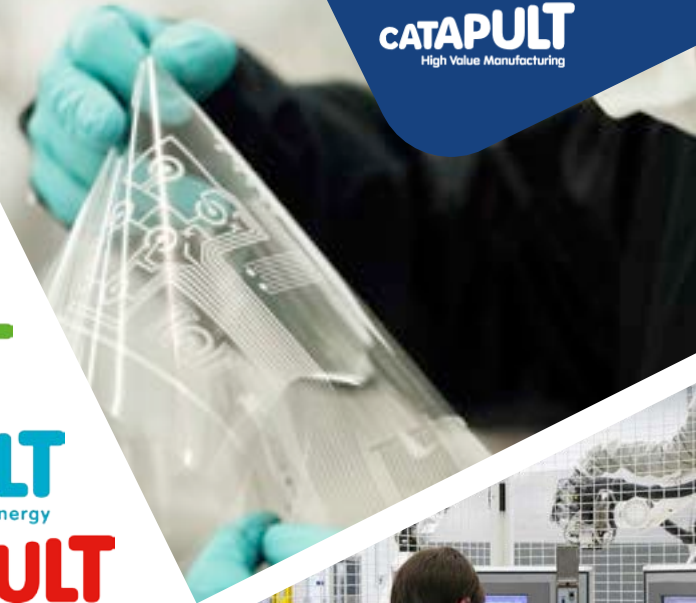
**cATAPULT**  
Satellite Applications

**cATAPULT**  
Transport Systems

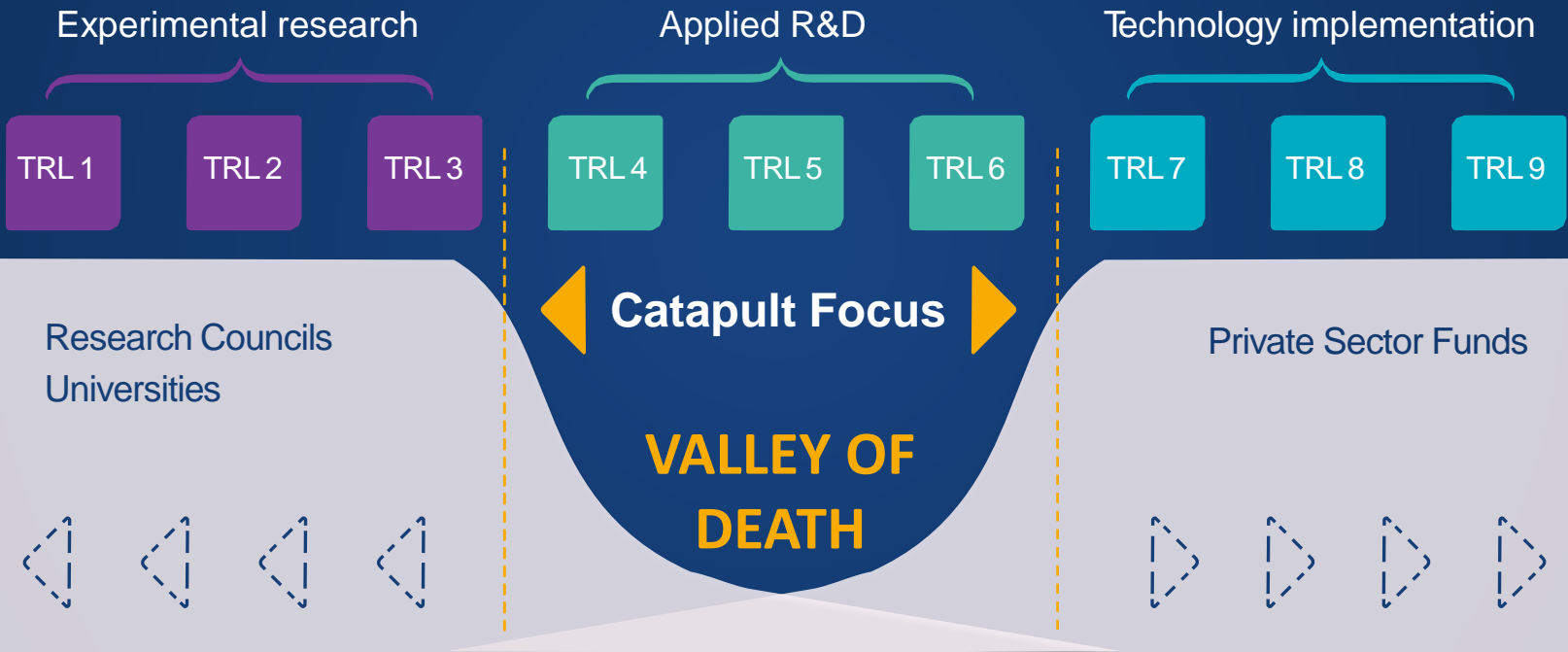
**cATAPULT**  
Energy Systems

**cATAPULT**  
Precision Medicine

**cATAPULT**  
High Value Manufacturing



# Bridging the Valley of Death



# HVM Catapult Overview

**CATAPULT**  
High Value Manufacturing

## AFRC

Advanced Forming  
Research Centre

## CPI

Centre for  
Process  
Innovation

## NCC

The National  
Composites Centre

## NAMRC

Nuclear Advanced  
Manufacturing  
Research Centre

## AMRC

Advanced  
Manufacturing  
Research Centre

## MTC

Manufacturing  
Technology Centre

## WMG

Warwick  
Manufacturing  
Group





AFRC

ADVANCED FORMING RESEARCH CENTRE  
UNIVERSITY OF STRATHCLYDE



CATAPULT  
High Value Manufacturing


## The Advanced Forming Research Centre

Strathclyde



### Key competencies

- Die life improvement
- Forging
- Residual Stress
- Thermal Processes
- Material characterisation
- Superplastic & incremental sheet forming



FORMING RESEARCH CENTRE



Advanced Manufacturing  
Research Centre



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High Value Manufacturing

## Advanced Manufacturing Research Centre

Rotherham



### Key competencies

- Advanced machining & materials research
- High performance machining
- Advanced structural testing
- Hybrid and metallic composites
- High value assembly
- Design and Prototyping







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High Value Manufacturing

**Centre for Process Innovation**  
Wilton & Sedgefield



## Key competencies

- Printable electronics
- Industrial biotechnology and Biorefining
- Biologics
- Formulations and Flexible Manufacturing





**mtc**

Manufacturing  
Technology Centre

**CATAPULT**  
High Value Manufacturing

**Manufacturing Technology Centre**

Coventry



## Key competencies

- Intelligent automation
- Advanced tooling & fixturing
- Electronics manufacturing
- Net shape & additive manufacturing
- High integrity fabrication
- Non-conventional Machining
- Metrology & non-destructive testing
- Manufacturing Informatics and Simulation





NATIONAL  
COMPOSITES  
CENTRE

**CATAPULT**  
High Value Manufacturing

## The National Composites Centre Bristol



### Key competencies

- Design, analysis, simulation of advanced composite applications
- Product & process development & optimisation
- Prototyping and validation
- Manufacturing, inspection & testing
- Knowledge transfer, training and specialised workshops





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High Value Manufacturing

NUCLEAR AMRC

## Nuclear Advanced Manufacturing Research Centre

Rotherham



### Key competencies

- Large-scale machining
- Advanced joining and cladding
- Near-net Shape (NNS) manufacturing
- Large-volume metrology
- Virtual environments
- Supplier development



**Warwick Manufacturing Group**

Coventry



## Key competencies

- Modelling, fabrication & characterisation of lightweight structures
- Design and characterisation of automotive composites
- Battery characterisation and development of new battery materials and prototype cells
- Modelling and physical verification of all-electric and hybrid drives
- Metrology and visualisation for the analysis of materials, body structures and battery technologies



## What we do

### Drive growth of manufacturing

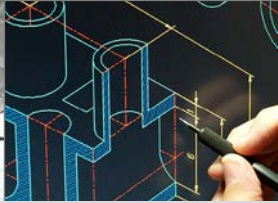
Help companies of all sizes incubate and develop new technologies to commercial reality

### Take the risk out of innovation

Give business access to

- World class open sourced equipment
- The UK's best relevant research knowledge
- At elbow support from engineers, scientists, technicians
- An environment of collaboration and open innovation
  - Cross sector
  - Cross technology
  - Whole supply chain
  - Even among direct competitors





Advanced Assembly

Automation

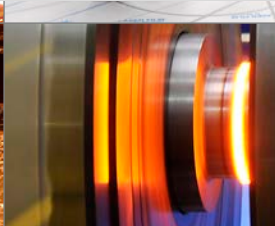
Biologics

Biotechnology

Casting

Composites

Design



Digital Manufacturing

Electronics

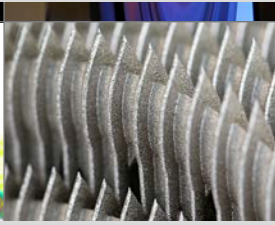
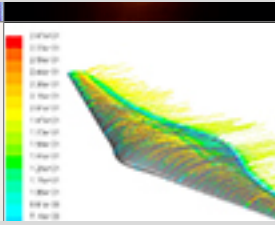
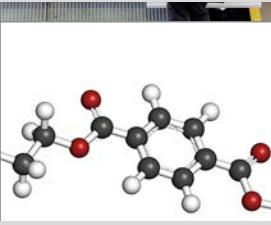
Flexible manufacturing

Formulation

High Temp Processing

Joining

Machining



Polymers

Materials Characterisation

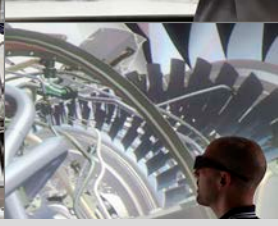
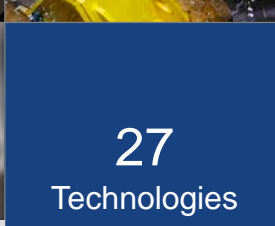
Metal Forming & Forging

Metrology

Modelling & Simulation

Netshape & Additive

Powder Technology



Power & Energy Storage

Efficient & Sustainable

27  
Technologies

Printable Electronics

Surface Engineering

Tooling & Fixtures

VR & Visualisation

# TiTan X-Treme

Record-breaking tooling for titanium

## The Challenge

Optimised systems for high-speed machining of the toughest alloys

## Involvement from AMRC

Using high-performance machining capabilities at AMRC - five-axis milling centre – and NAMRC - horizontal boring machine

## The outcome

Patented system now used in titanium machine shops around the world



**Nikken invest in new R&D  
Centre in Rotherham**



Advanced Manufacturing Research Centre







# MMTech

## Electron Beam Additive Manufacturing



### The challenge

EBM of Ti, stainless and corrosion resistant steel



### Involvement from CPI

Access to K-2000 pro-beam, largest EWB facility in the UK



### The outcome

Deposition of Ti, stainless and corrosion resistant steel at 1- 4 kg/h with excellent surface finish

**Horizon 2020 funded new ways of working with the advanced alloy gamma titanium aluminide.**



# Crushable Structure

## Mars Return Capsule

### The challenge

Develop an energy-absorbing structure for the Mars Sample Return mission.

### Involvement from MTC

Advised on appropriate AM process and materials, built sample lattices by EBM, carried out metallurgical analysis and X-Ray CT scanning of built samples

### The outcome

The lattice samples were successfully crush tested by Magna Parva as part of the Thermal Protection System project.

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High Value Manufacturing

# Manufacturing of cranial plates

## Incremental sheet forming

### ► The Challenge

Decrease patient waiting times and improve surgical outcomes

### ► Involvement from AFRC

Pre-clinical collaboration between AFRC, Pascoe Engineering Ltd and the NHS. Establishing incremental sheet forming techniques and key processes

### ► The outcome

Potential new market for Pascoe Engineering  
Significant reduction in cost and better surgical outcomes



# Advanced Winglet Development

## Design & Production Processes

### The Challenge

Decrease production times and improve end-product quality, consistency and repeatability

### Involvement from HVMC

Lower skin composite design and automated production process developed at NCC

### The outcome

Production time significantly reduced whilst quality is maintained

**GKN Winglets are now  
produced on the Isle of White**



# Plaxica

Plastics from renewable feedstocks



## The challenge

Aim to reduce reliance on oil-based products by using more environmentally sustainable processes



## Involvement from CPI

Develop and scale-up production process.  
Facilities and extensive technical and analytical support

**2 Plaxica laboratories from CPI in Wilton and recently launched own pilot plant on site**

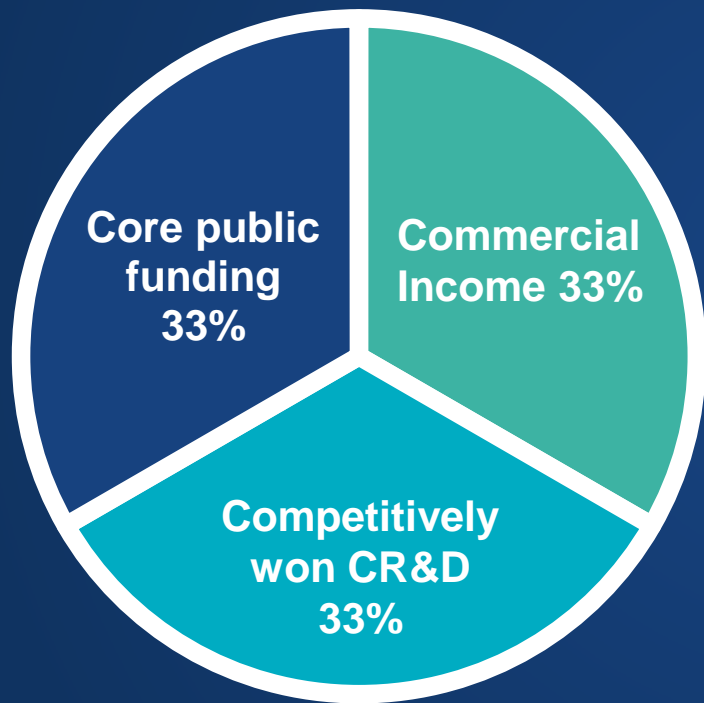


## How are Centres Funded?

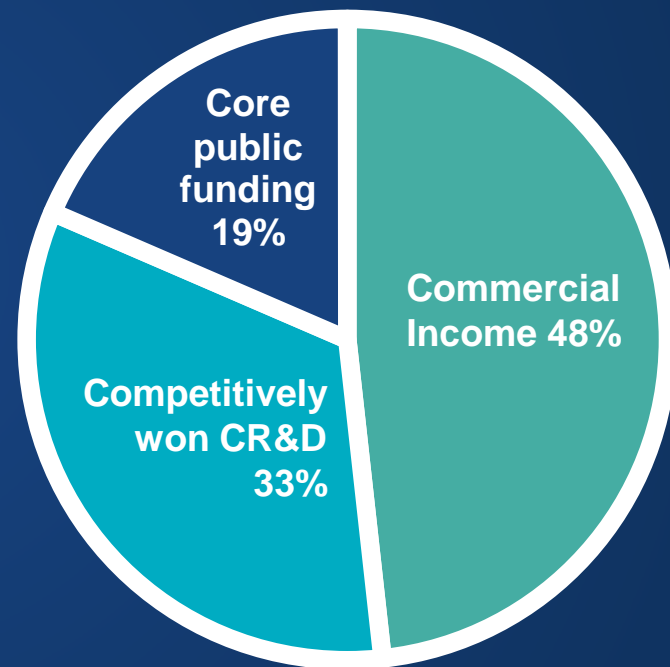
The funding model draws equally from 3 sources



# The Funding Model



**Model**



**2014-15 Actual**



Some companies we are working with



# Academic Collaboration

57 UK Universities

24 International Universities



## 2014-15 Performance in Numbers

- ▶ **£4.36** CR&D and commercial income levered for every **£1** public core funding
- ▶ **1514** private sector clients of which **629** were SMEs
- ▶ **1259** projects
- ▶ **£218m** total income
- ▶ **£110m** innovation income accessed by SME's
- ▶ **1577** staff





## Economic Impact

£107m of core funding to date has delivered:

- ▶ **£290m** R&D investment
- ▶ **£1.6bn** additional value to UK economy

...a **15:1** benefit



More resources at:

**[www.hvm.catapult.org.uk](http://www.hvm.catapult.org.uk)**