

Agenda

- 10.00 Welcome, John Lorimer, Chair CE Offsite Group
- 10.05 Overview of AMRC, Allan Griffin
- 10.45 Q&A
- 11.00 Tour of Factory 2050
- 12.30 Lunch
- 13.30 CE Offsite Group Discussion
- 15.00 Close

Constructing Excellence Offsite Group Meeting



The AMRC: Where Construction Meets Manufacturing

Profitability through Productivity

Allan Griffin

Head of Construction & Infrastructure Strategy

10th May 2018

Supported by the
 Regional Growth Fund

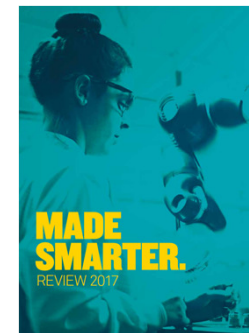
CATAPULT
High Value Manufacturing

 **European Union**
European Regional
Development Fund

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Template - AMRC.PPT Revision 1 (June 2016)

General Intro

- No fire alarms planned – if it goes off please follow your host
- Amenities
- Please refrain from taking photographs
 - We have stock photos that can be used if required
- Tour groups
 - Name badges have a number on – this relates to your tour group
 - Please stay with your group
 - No specific PPE required today
- Hosting Juergen Maier's Northern Powerhouse Speech today
 - Chief Executive of Siemens UK
 - Author of the Made Smarter Review
 - an independent review of industrial digitalisation



Your input to help us to help you

Capture ideas from you to help guide future developments.

- **What productivity or quality challenges do you face as a business or industry?**
- **How could the technology you've seen at the AMRC be used?**
- Construct a challenge statement in context for us
- Can be anonymous or attributed
 - **When** I assemble light gauge steel frames off-site **I want to** check that all the components are present, in the right place and the frame is within tolerance **so that** I have confidence they will fit together when assembled on site.

There is a google form <https://bit.ly/2w7nGvM> - this will be open for a week after the event

More traditionally there are flip charts, post-its and pens so please feel free to submit your thoughts.

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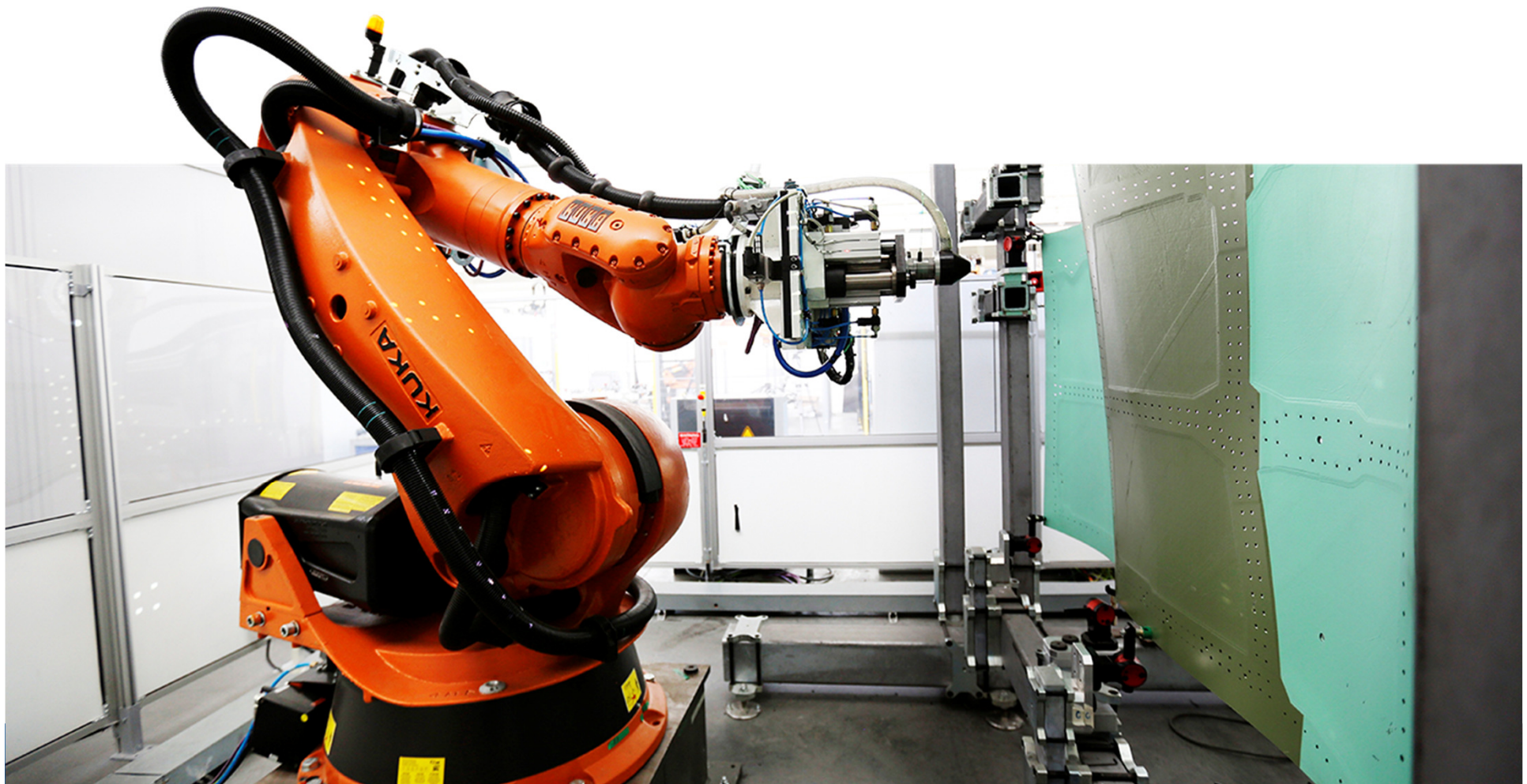
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Our groundbreaking manufacturing techniques are helping Rolls-Royce transform the production of components for some of the world's most advanced passenger jets.



AMRC have reduced the time it takes to manufacture each disc by 50%

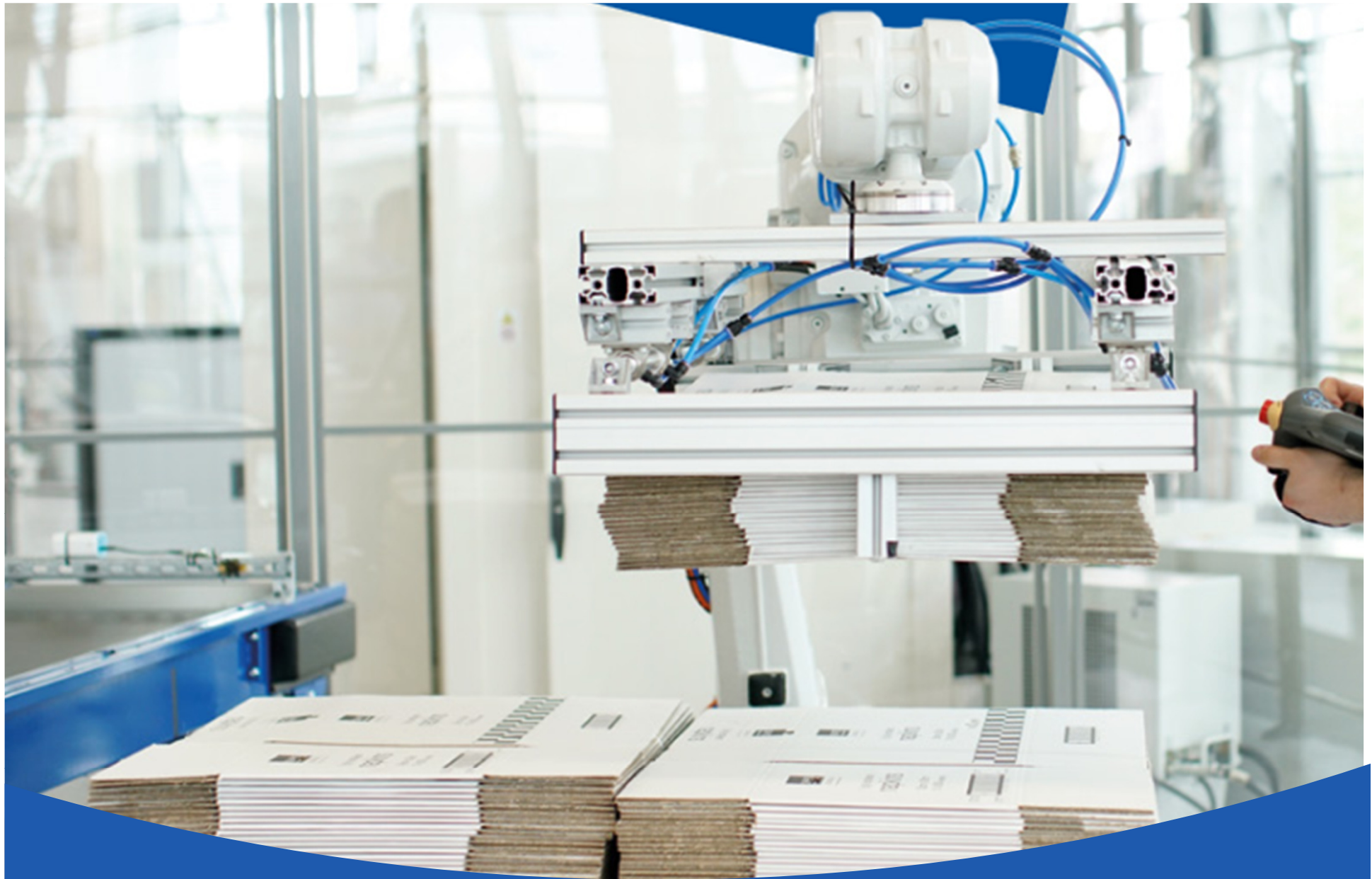
Saving BAE Systems millions of pounds in capital and operational costs by accurately countersinking holes in composite aircraft components using robots.





AMRC Members

May 2017



Smart technology delivers SME productivity & H&S gains

Industrial Strategy

AMRC Features as Case Study in the Industrial Strategy White Paper

Case Study: Advanced manufacturing in Sheffield City Region

The Sheffield City Region is home to an advanced manufacturing cluster with the University of Sheffield's Advanced Manufacturing Research Centre (AMRC) as its core. The AMRC is located on the Sheffield-Rotherham border, benefiting from government backing as part of the Sheffield City Region Enterprise Zone and as a centre for the High Value

Manufacturing Catapult. The park is undergoing rapid expansion, including high-profile investments such as McLaren's £50m manufacturing facility and a £110m Rolls-Royce Advanced Blade Casting Facility. The recent Science and Innovation Audit made clear the wider opportunities for an innovation corridor that can maximise the benefits of industry 4.0.

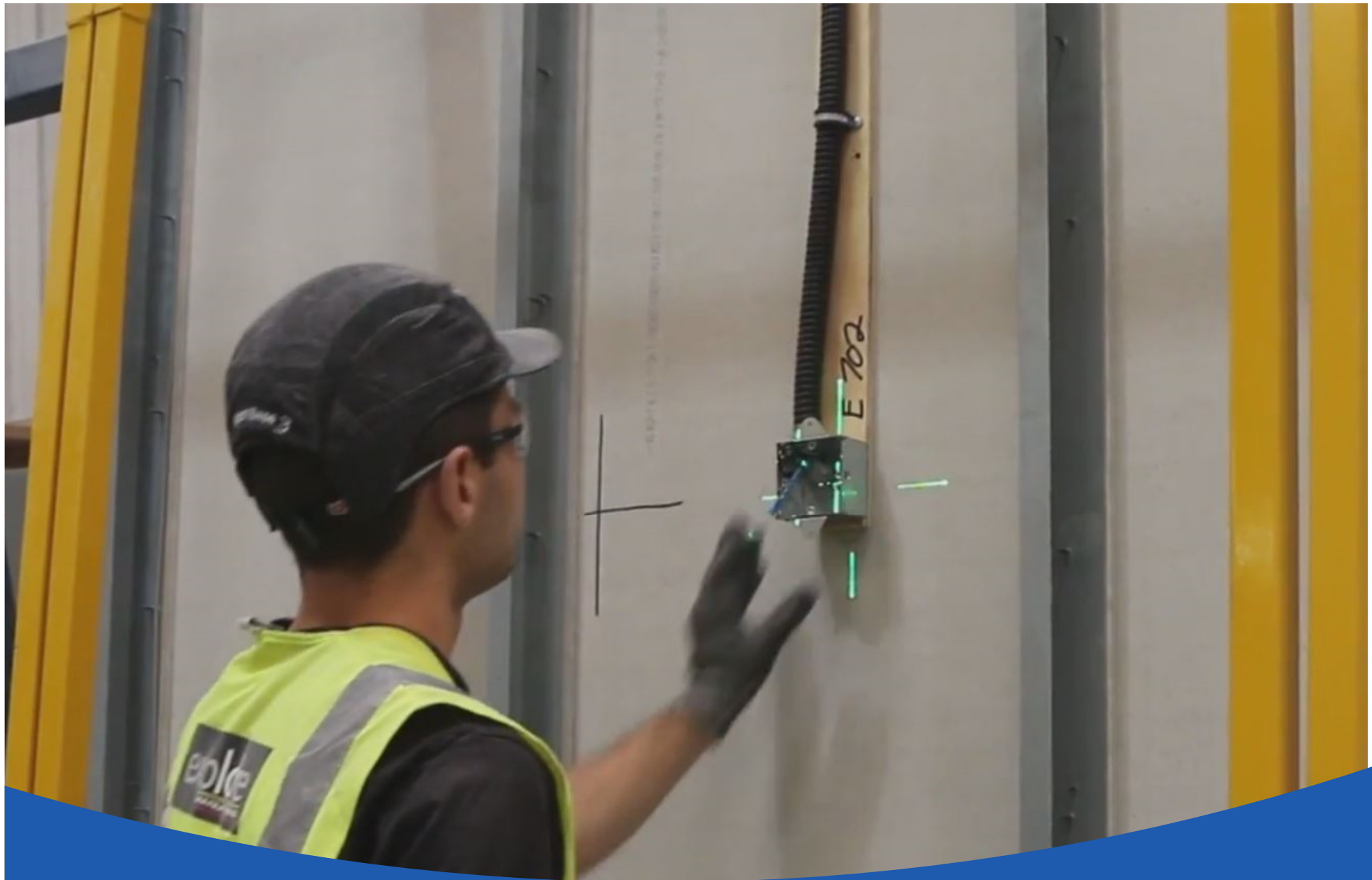


The AMRC Today

- Research hub at heart of the Advanced Manufacturing and Sheffield Business parks.
- 500+ researchers, technicians and support staff.
- Over 100 member companies – from global giants to local SMEs.
- Over £200 million investment brought to former coalfield.
- Part of Rolls-Royce & Boeing global research networks.
- 20,000 visitors a year to our facilities, including international, UK government and industrial decision-makers.



The AMRC: Where Construction Meets Manufacturing



Working with the AMRC delivered a 60% process time improvement for Laing O'Rourke's SmartWall Line

Construction & Infrastructure Sector Overview

Industry Challenge

2025 Targets

- 33%** lower costs
- 50%** faster delivery
- 50%** lower emissions
- 50%** more exports

£90bn GDP output

10% UK employment

≈1 fatality per week

20yrs flat productivity growth

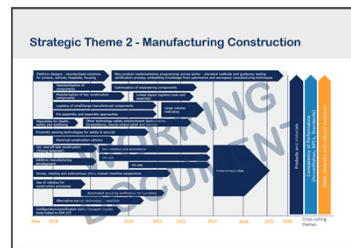
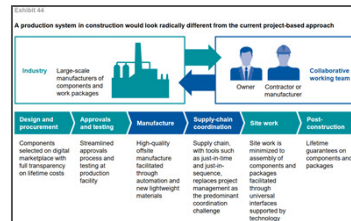
30% loss of skilled labour

99% supply chain are SME

1.2% avg. pre tax margin

- = Risk adverse
- = Non collaborative
- = Low R&D investment

Industry Response



→ digital & offsite construction

AMRC Vision & Strategy

AMRC C&I Vision
To be the go-to R&D organisation for industrialised construction

Identifying

relevant horizontal innovation opportunities.

Demonstrating

the art-of-the-possible

Developing

strong industry and academic links

Delivering

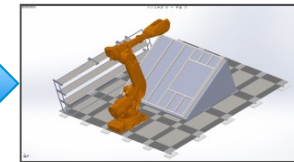
collaboratively funded research projects

Inspiring

change through thought leadership

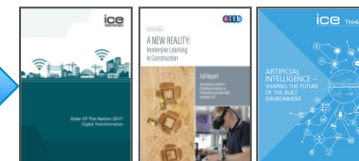
AMRC Activities

Digital, Automation, DES, I4.0, Metrology, Composites, AM, DPTG



Mark Farmer - advocate for us
Raising AMRC profile
Involvement with key players

Through our membership
Ongoing work
Developing with others



Department for Transport
DfT Science Advisory Council



NCE100 Technology Trailblazer Award 2017

Laing O'Rourke and AMRC recognised for Offsite manufacturing technologies for smart digitised construction



“

The collaborative way of working with AMRC is delivering tangible benefits for LOR and our customers.

The AMRC are at the cutting edge of advanced manufacturing and are working with us to exploit these technologies and solutions in the construction sector.

Their rigorous approach to maturity-proving through utilising readiness levels, is helping reduce risk and increase confidence in the solutions.”

David Brass,
General Manager Advanced Manufacturing at Laing O'Rourke

Improving Productivity of Traditional Construction

Roof Batten Joint Testing for KEAH Products Ltd

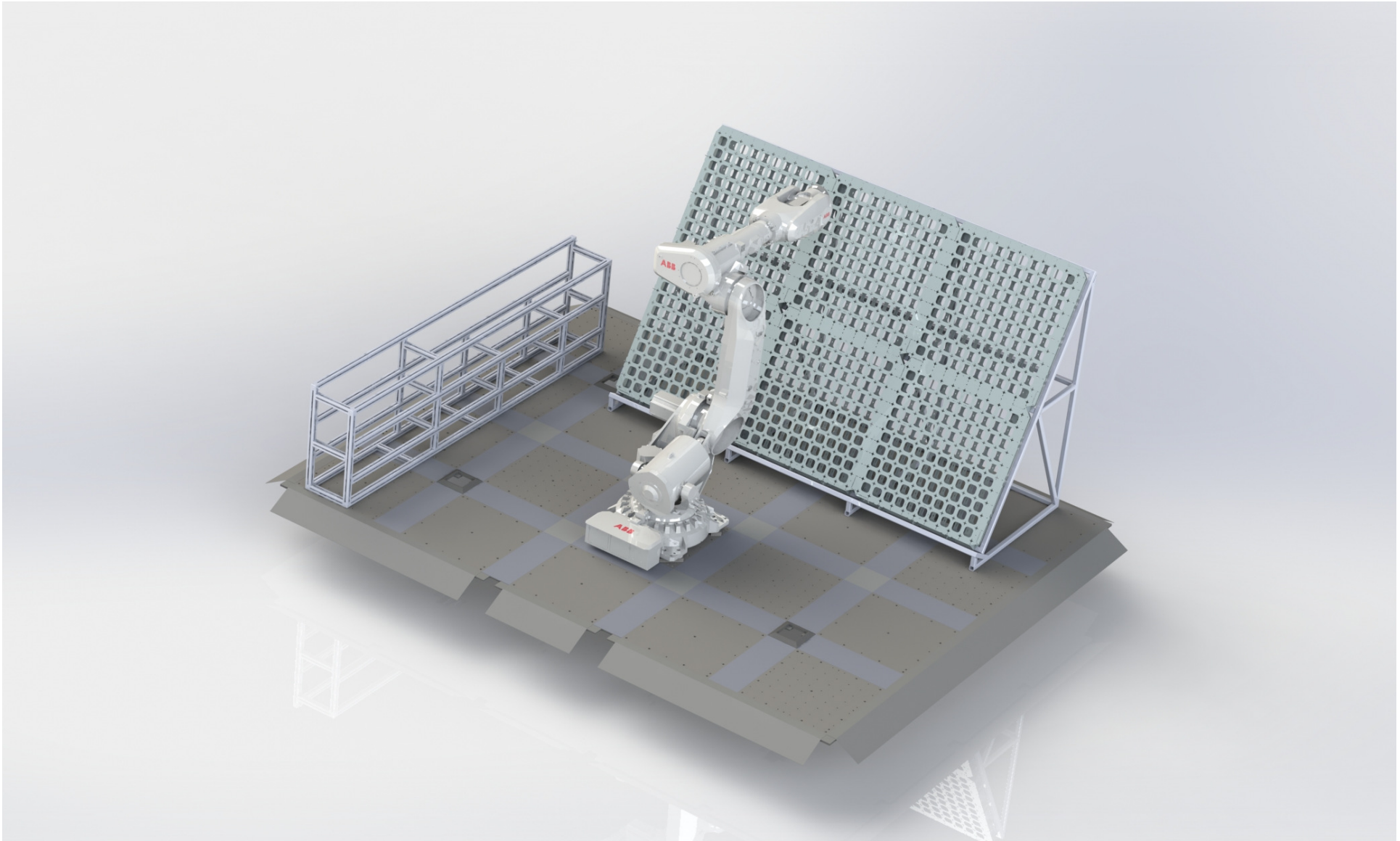
KEAH local SME - Developed an innovative system for improving productivity of roof construction.

Needed to test its performance compared to traditional methods.

Used the AMRC ASTC who are UKAS accredited for flexible scope



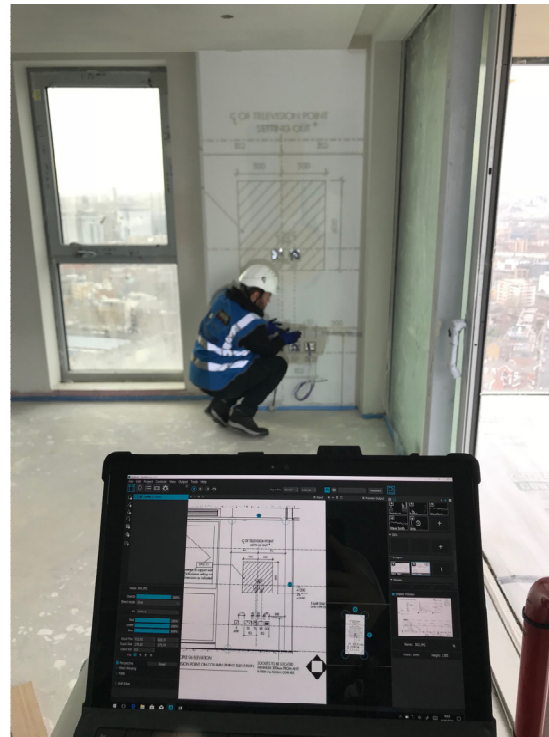
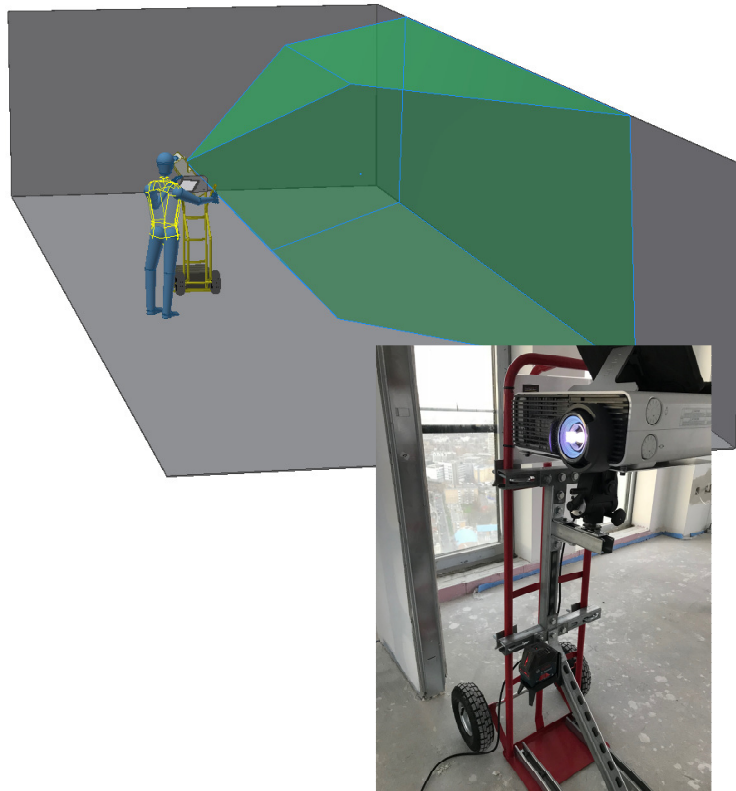
Automated Construction Demonstrator



Smart Setting Out

SmartSet

- Design is undertaken in BIM but the digital journey stops once the first brick is laid.
- Can scaled digital information be provided to improve setting out?
- Significant productivity improvements realised in trials



“

I am convinced that the AMRC is playing a significant role in helping support the construction sector make the change to the smarter, offsite production methods outlined in my report.

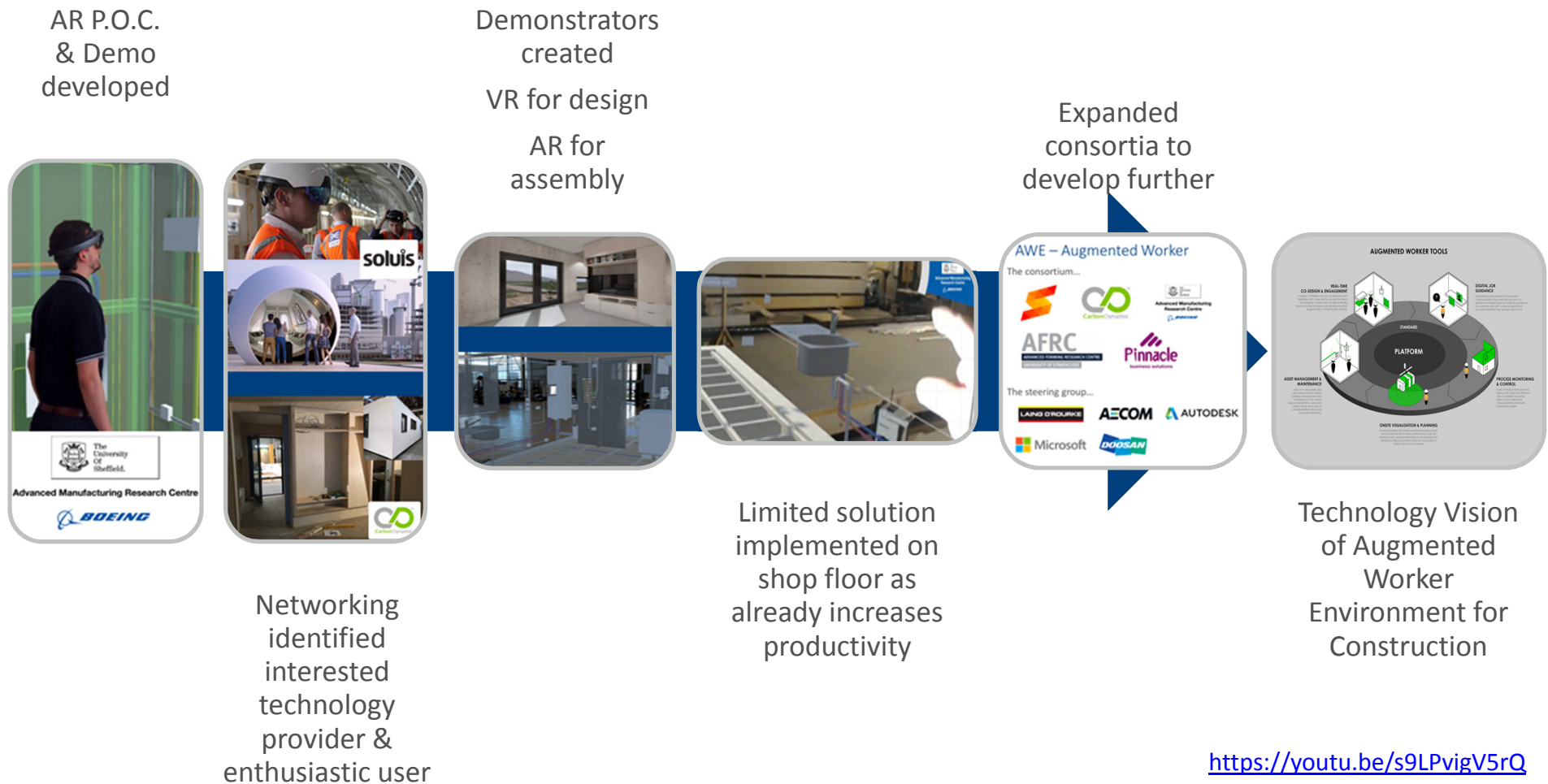
What really impresses me about their approach to developing technology is how they are making it is easy for the industry to adopt.

The Augmented Worker programme in particular has significant potential for the future of how we train workers and use digital technology in the working environment.”

Mark Farmer, CEO of Cast Consultancy and author of the 'Farmer Review'.

Development of the Augmented Worker Environment

Key Steps From Proof-of-Concept to Industry Implementation



<https://youtu.be/s9LPvigV5rQ>

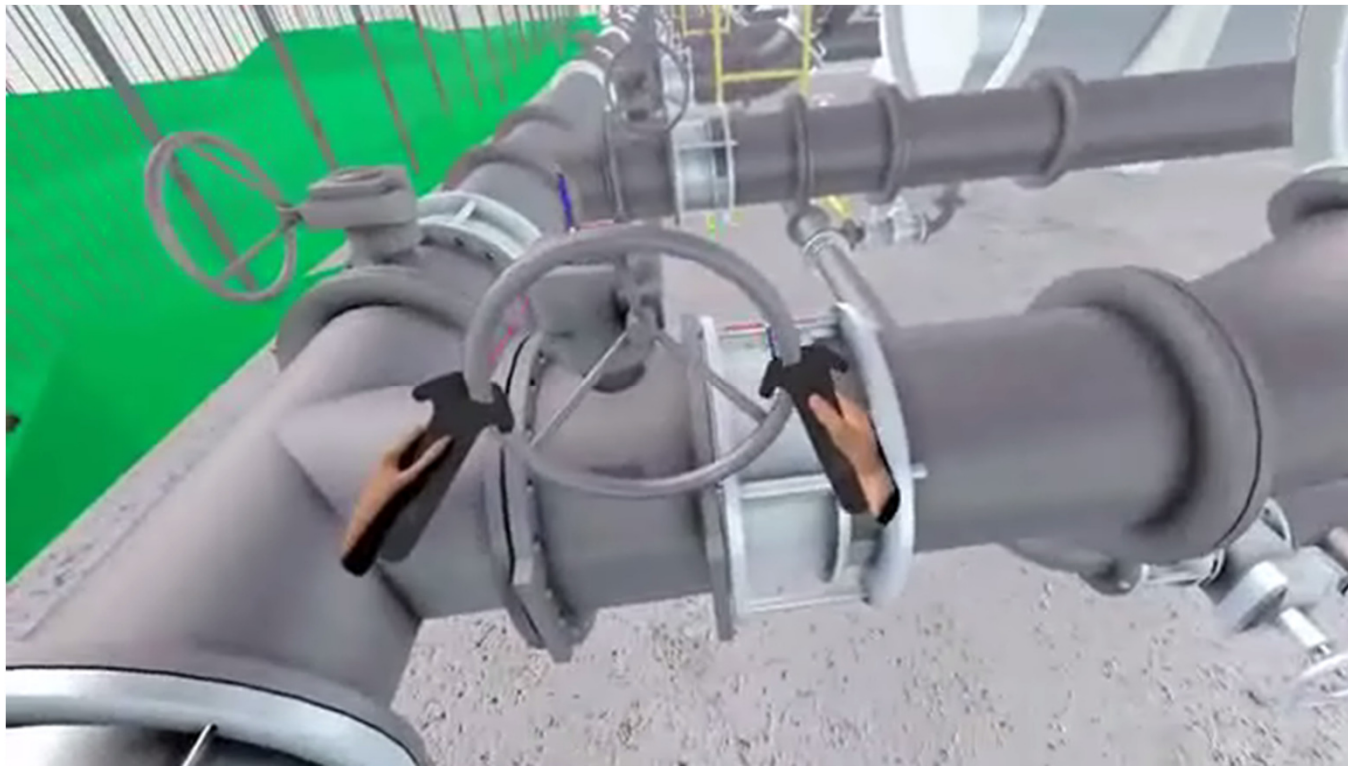
The Augmented Worker

The Augmented Worker.

Yorkshire Water – Irton Digital Twin

Virtual reality gaming technology helping Yorkshire Water engineers design futuristic sites

- Avoids the building of physical prototypes.
- Allows stakeholder communication to understand the design and suggest improvements.
- £180,000 saved so far and has the potential to reach £1m savings by 2020.



Advanced Manufacturing Park Campus 1980's




AMRC Advanced Manufacturing Campus Today



Manufacturing Research

Our R&D spans the middle steps of the Manufacturing Readiness Level Ladder – taking technologies from the laboratory to the factory gate.

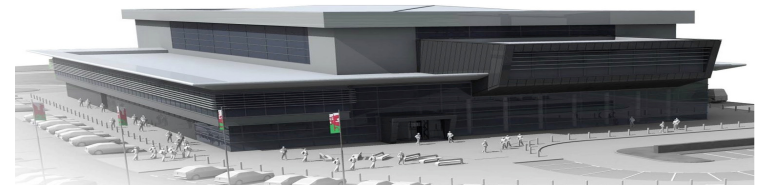
Manufacturing Readiness Level (MRL)		
Phase	MRL	State of Development
<i>Phase 3:</i> Production Implementation	9	Full production process qualified for full range of parts and full metrics achieved
	8	Full production process qualified for full range of parts
	7	Capability and rate confirmed
<i>Phase 2:</i> Pre-production	6	Process optimised for production rate on production equipment
	5	Basic capability demonstrated
<i>Phase 1:</i> Technology assessment and proving	4	Production validated in lab environment
	3	Experimental proof of concept completed
	2	Application and validity of concept validated or demonstrated
	1	Concept proposed with scientific validation



AMRC

AMRC Top Level Strategy

- Help manufacturers of any size to become better, faster, cheaper and greener by introducing advanced manufacturing techniques, technologies and processes.
- Accelerate and de-risk innovation & technology transfer into industry.
- Enable the UK's manufacturing and materials industries to be the most connected, digitised and flexible in the world
- To enable the UK to 'make its own future' by increasing and anchoring domestic manufacturing and materials capacity for high value, next generation products.



Part of the High Value Manufacturing Catapult

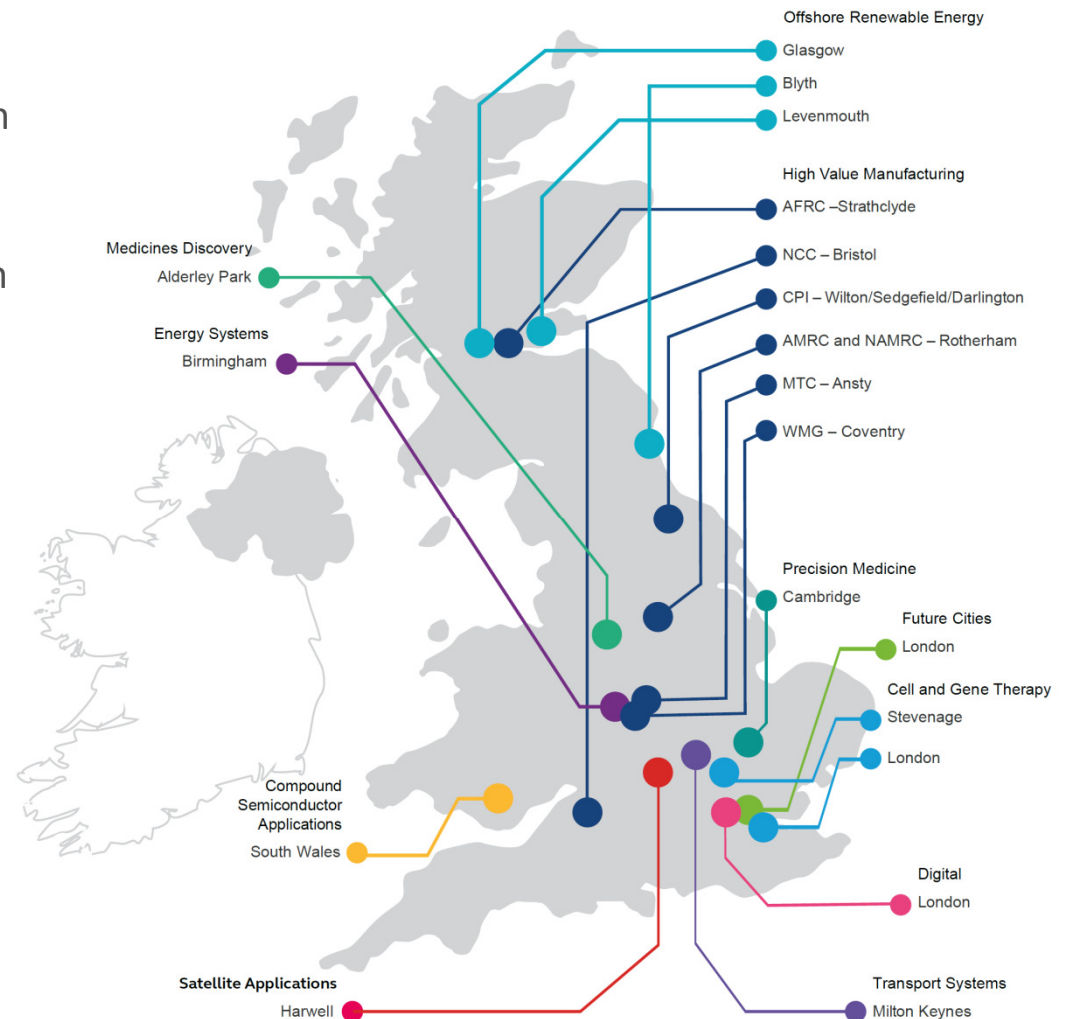
What is a Catapult?

Catapult centres are there for all businesses looking to undertake late stage R&D and commercialise traditional academic research

The [High Value Manufacturing](#) (HVM) Catapult is the catalyst for the future growth and success of manufacturing in the UK.

Established and overseen by Innovate UK, with over £200 million of government investment.

The AMRC with Boeing & Nuclear AMRC are 2 of the 7 centres within the HVM Catapult.



Factory 2050



Integrated Manufacturing Group

Themes and Capability Summary



Robotics and Automation

Industrial robots
Bespoke Automation
Kinematics
Robotic Drilling/C'sinking
Robotic Machining,
Robotic adhesive application
Reconfigurable Fixturing
Human-robot collaboration
AGVs and part movement



Integrated Large Volume Metrology

Laser trackers
White Light Scanner
K600 optical CMM (K-cam)
ROMER arm
Advanced Vision Systems
Factory Scanning
Robotic NDT
iGPS



Digital Team

Augmented Reality
Digital Work Instructions
Manual Assembly
Intelligent Tools (DC)
Virtual Reality
Digital Twin
Optical Projection
Laser Projection
Wearable technologies



Manufacturing Informatics

RF Part tracking
SCADA / WinCC
Factory Dashboard
Control Systems
Programming
Integrated Sensors
Low-power wireless
Sensors Networks
Analytics

Case Study

Robotic Countersinking

- Development over 3 years
- Projects inc:
 - PLC
 - Inspection
 - EE Redesign
 - Programming
 - Fixture Dev.
- 55s → 14s with added inspection
- Smaller more robust EE



Case Study

Cleat Drilling

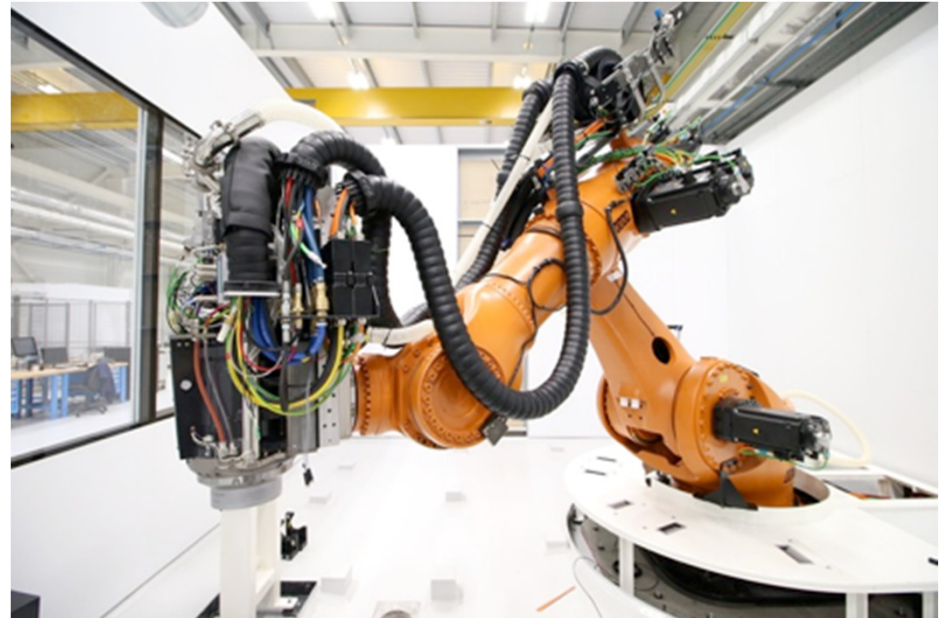
- Development of 1 shot drilling system (from multi stage)
- Development over 18 months
- 60s+ → sub 15s
- Concept to TRL 6
- On site trials (multiple aircraft platforms)



Case Study

Robot Machining

- Development of capability
- Dynamic analysis of structure
- Programming Development
- Cutter Development
- Aiming to improve to 0.1mm
- £1m investment



Case Study

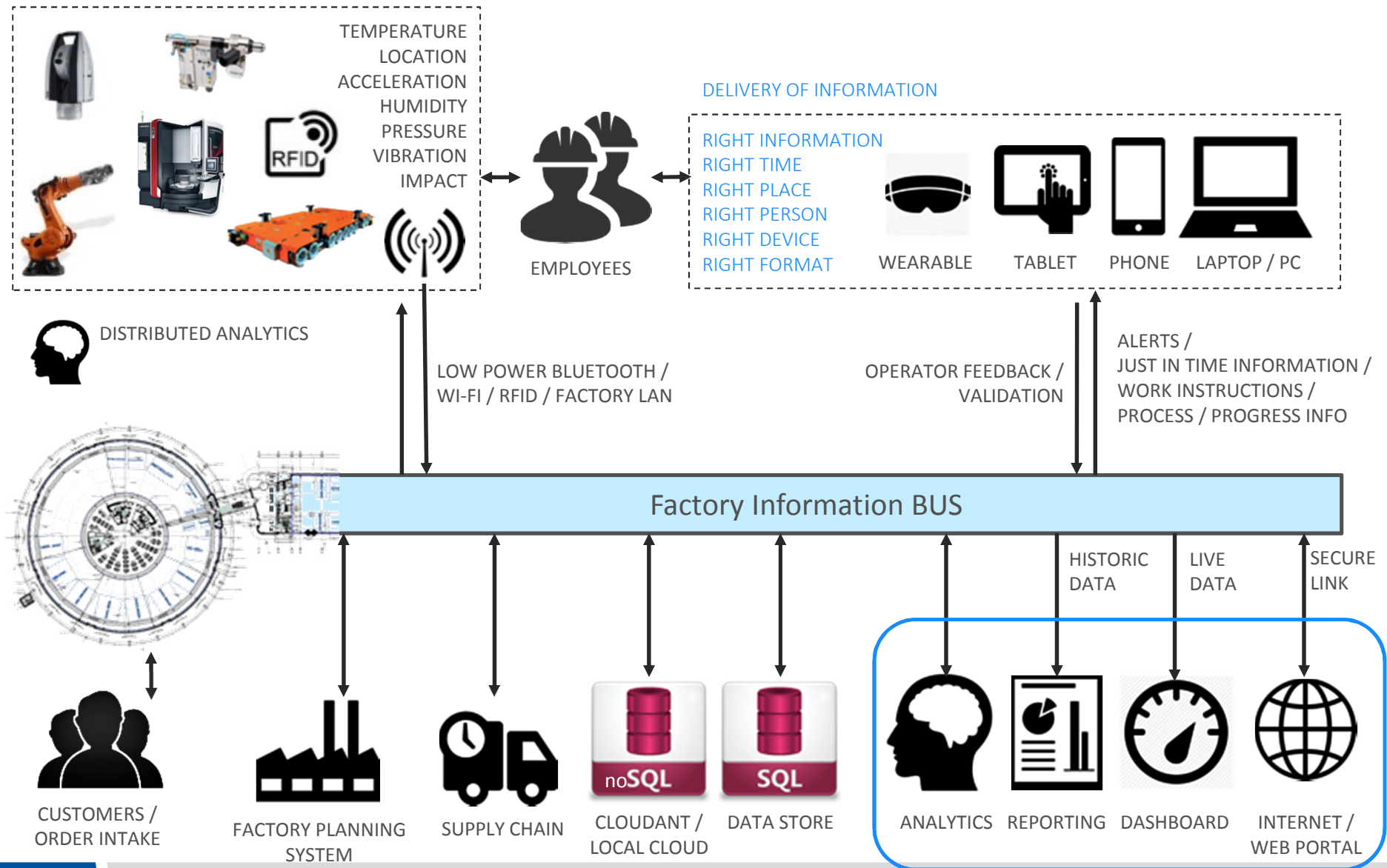
Factory Scanning

- Allows the measurement of large areas quickly
- Can be used in CAD and VR environments
- Can be linked to DES information to simulation production flow in various scenarios.



Factory 2050 – The SMART Factory

SENSORS / EQUIPMENT



What do we do?

AMRC
ADVANCED MANUFACTURING
RESEARCH CENTRE



The
University
Of
Sheffield.

<https://vimeo.com/263475618>

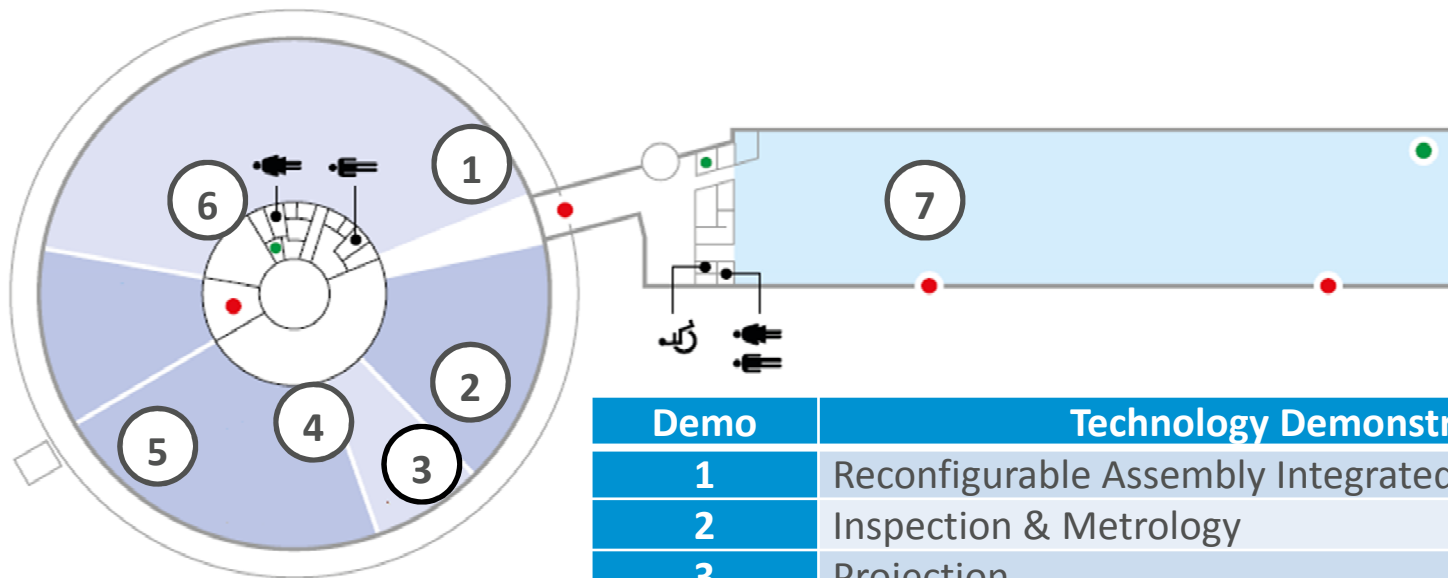
Factory 2050 Tour

What you will see today

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Please stay with your group



Demo	Technology Demonstrators
1	Reconfigurable Assembly Integrated Demonstrator
2	Inspection & Metrology
3	Projection
4	Augmented Reality
5	Automated Assembly
6	Smart Factory Demonstrator
7	IOT for Legacy Equipment & large scale robots



Thank you.

For further information please contact or visit:

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Twitter: [@theAMRC](https://twitter.com/theAMRC)