

Activating the 'Triple Helix' to Bridge the Technology Readiness Level Gap & Create Impact

ScotCHEM Recent Appointees Workshop
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Dr Heather Anderson

heather.e.anderson@strath.ac.uk

University of Strathclyde, Glasgow, UK

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- University of Strathclyde Introduction
- So, What's the Problem?
- The 'Triple Helix'
- Approach to Collaboration



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University of Strathclyde – Where, What, Who...?



University of Strathclyde: A Leading International Technological University
“The place of useful learning”

- c.25,000 students from over 100 countries (18,000 UG, 7,000 PG)
- 3,800 employees: 1,800 Academics
- Turnover around £320M p.a.
- Largest Engineering University in Scotland, Second largest in UK
- Triple accredited Business School
- One of 13 UK University EPSRC Framework Partners
- Part of four Catapult centres:
 - Offshore Renewable Energy Catapult
 - High Value Manufacturing Catapult
 - Transport Systems Catapult
 - Satellite Applications Catapult
- Host of the first & only Fraunhofer in UK – FCAP
- Strategic Partner with the National Physical Laboratory – NPL Scotland



Professor John Anderson
Anderson's Institution Founder



Professor Sir Jim McDonald
Principal & Vice-Chancellor

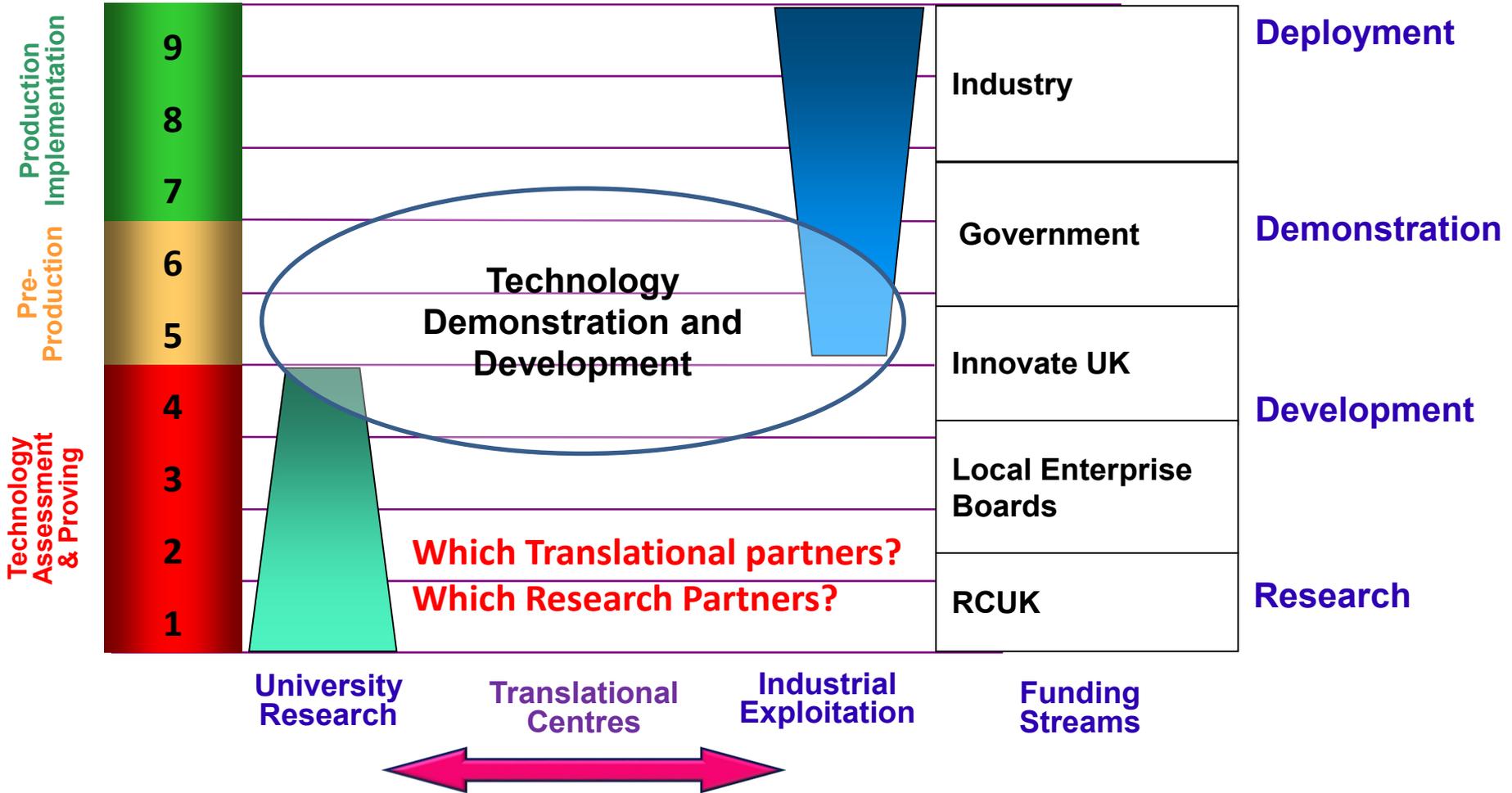


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So, What's the Problem?



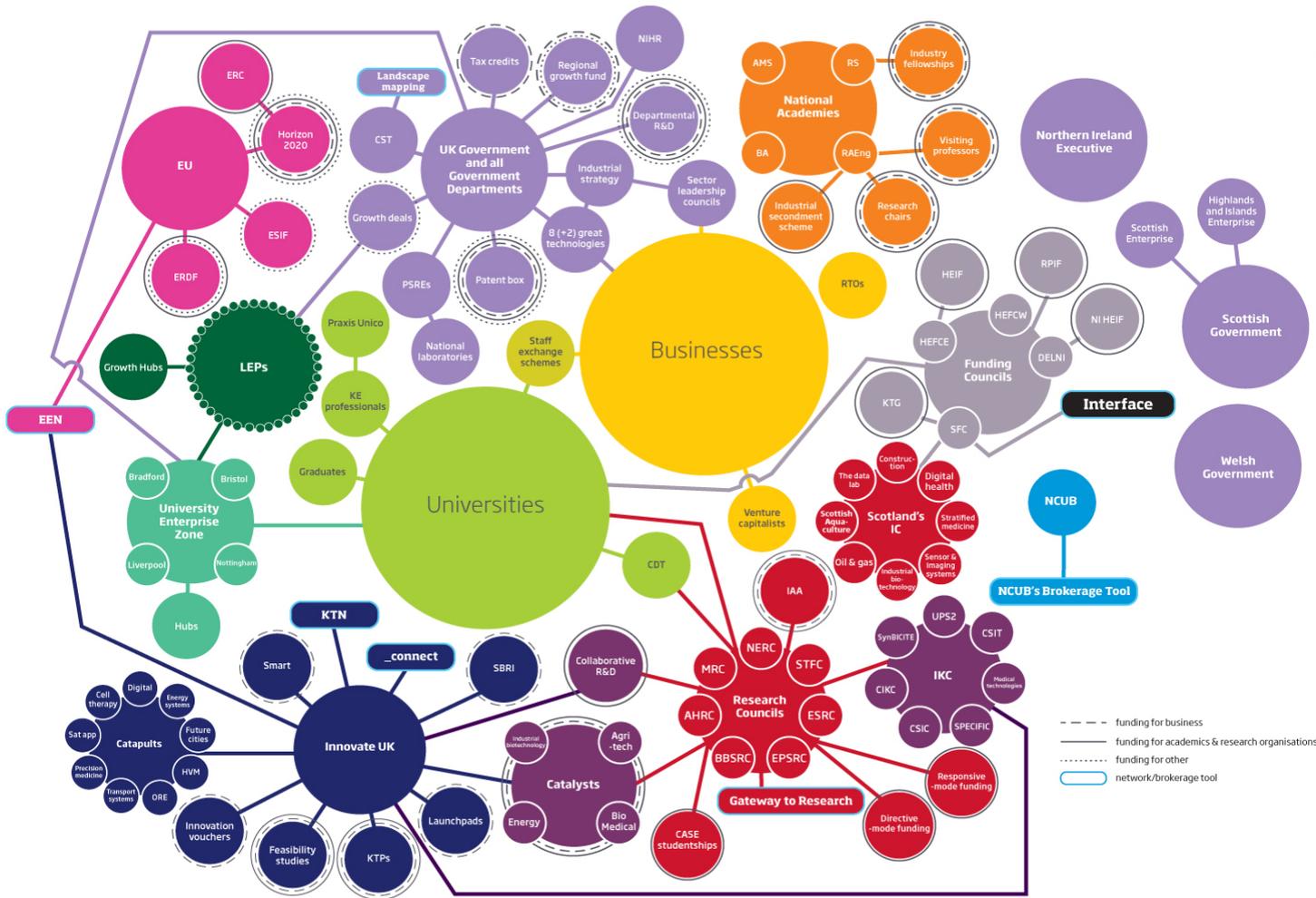
TRL 'Valley of Death...' '...Valley of Opportunity'



Working with Industry to understand key challenges
Working with Universities to create the local/ International support networks

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So, What's the Problem?

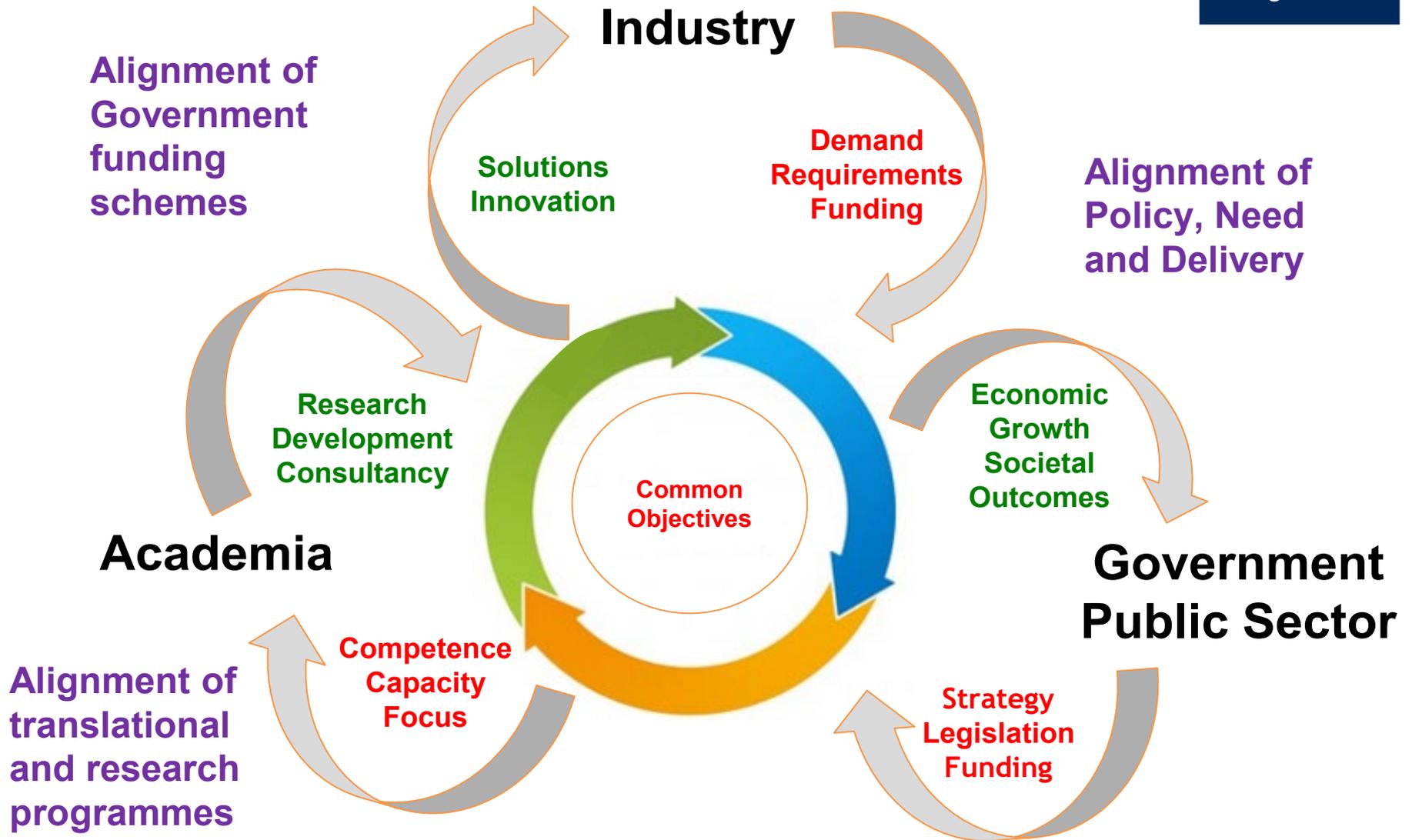


UK Research & Innovation
 Merging 7
 Research Councils,
 Innovate UK and
 HEFCE Research
 Funding

UK Industrial Strategy: Simplifying the funding landscape

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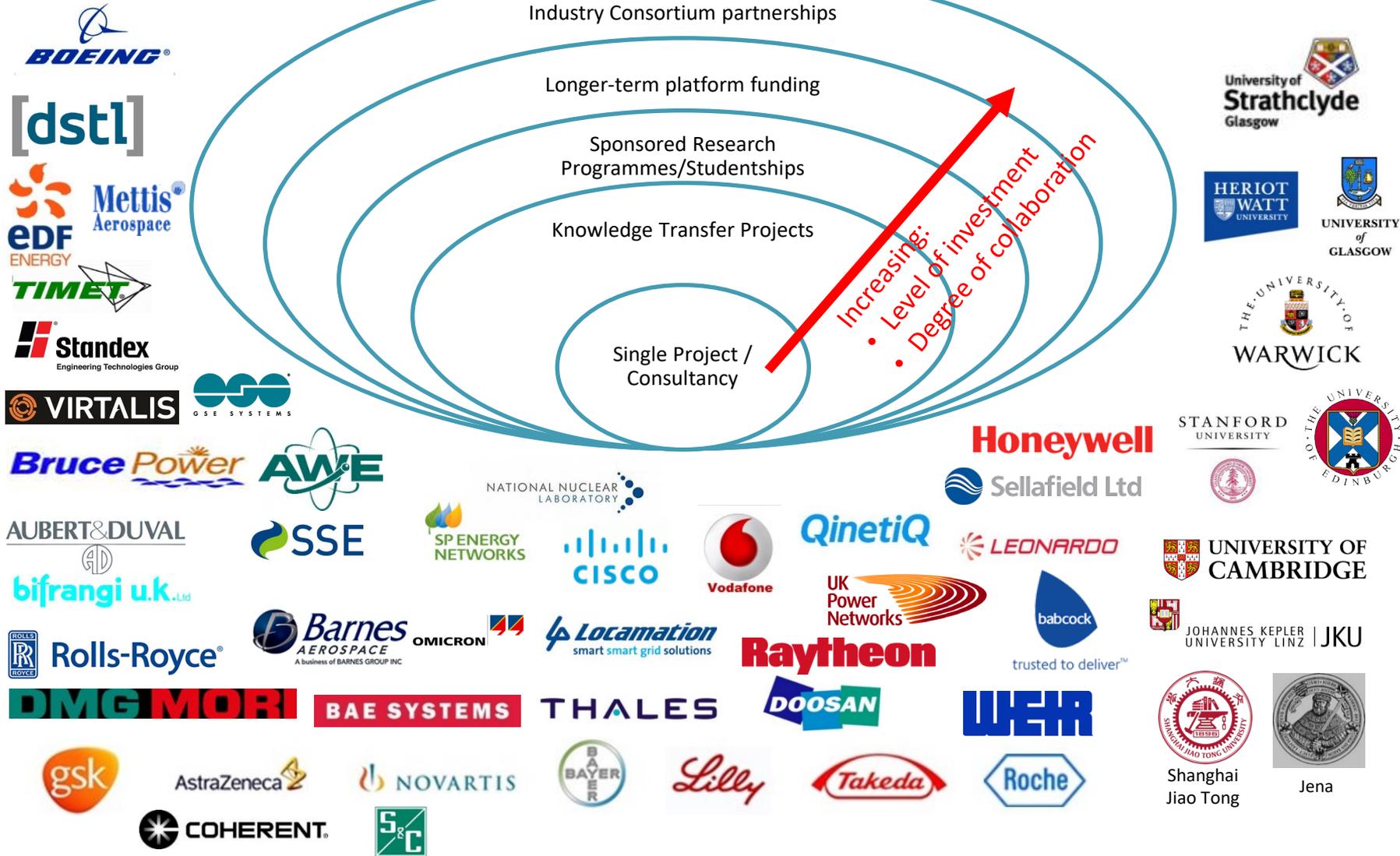
The 'Triple Helix'



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Industry Partnerships

The Strathclyde way: No 'one size fits all'



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Strathclyde Approach: Repeatable, Sustainable Collaboration



Energy Technology Partnership (ETP)
 13 independent Scottish HEIs providing world-class capability & resources in energy RD&D



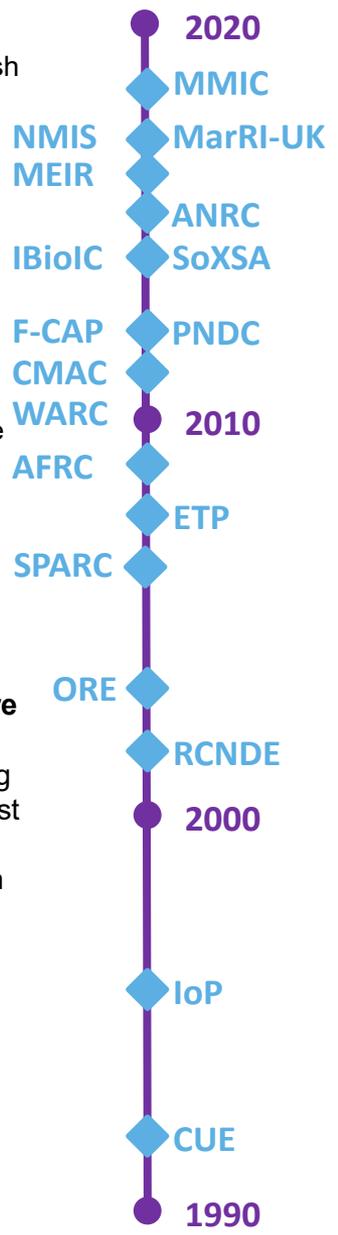
Advanced Nuclear Research Centre (ANRC) Enhancing the performance & extending the life of nuclear assets.



Power Network Demonstration Centre (PNDC)
 Unique facility enabling Industry to develop, test & demonstrate products & solutions in a real distribution network environment



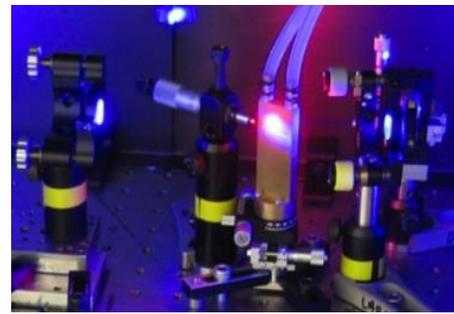
Centre for Ultrasonic Engineering (CUE)
 >30 years of expertise in design & Implementation of ultrasonic transducers with Industry



Satellite Applications Scottish Centre of Excellence (SoXSA)
 End-to-end focus on enabling new space mission technologies delivering data products



Fraunhofer Centre for Applied Photonics (F-CAP) Applied research, development & engineering of advanced laser sources & optical technologies for industrial applications



Off-Shore Renewable Energy (ORE)
 UK's largest clean growth opportunity accelerating the creation and growth of offshore renewable energy companies



Institute of Photonics (IoP)
 Created to 'bridge the gap' between academia & industry in photonics: solid-state lasers, semiconductor optoelectronics & bioscience



Centre for Ultrasonic Engineering

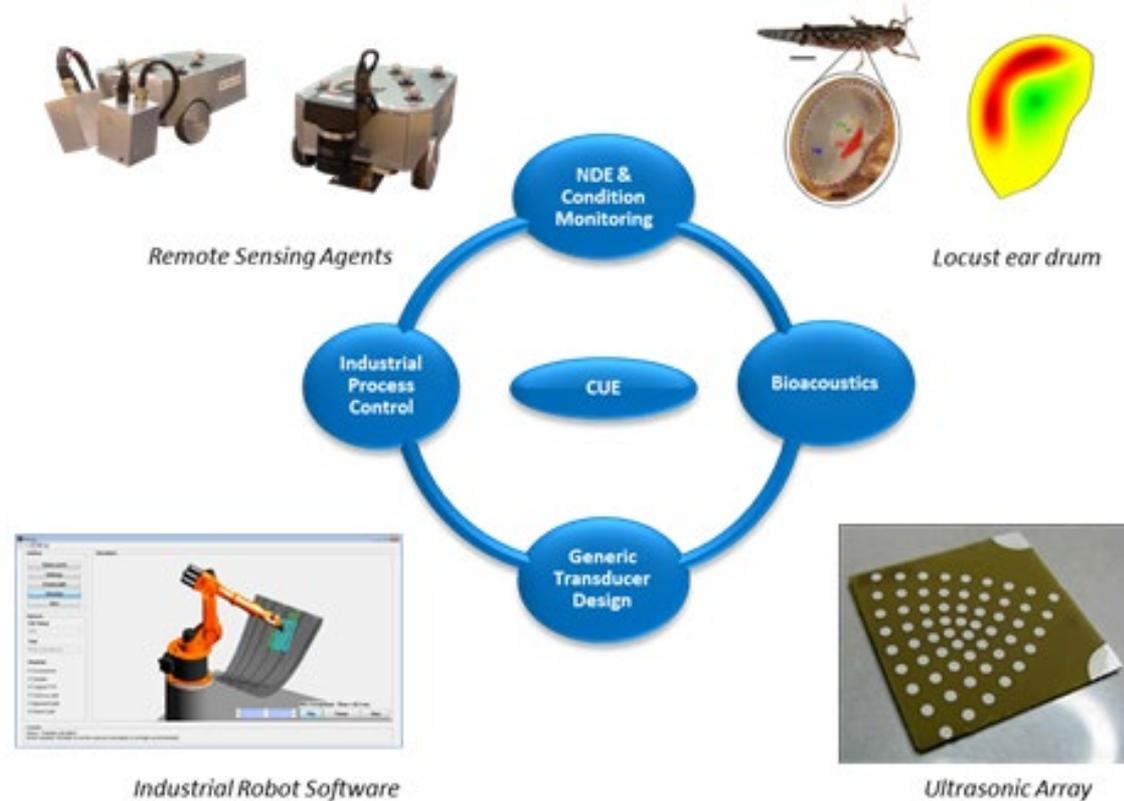
Founding member of the UK Research Centre for Non-Destructive Evaluation (RCNDE)

Working in underwater sonar, biomedical imaging and therapy, non-destructive testing and industrial process ultrasound.

Expertise in ultrasonic transducer manufacture, system prototyping, instrumentation hardware, system simulation and data processing software

Current work:

- Development of new robotic applications (inc. Automated integrated inspection capability)
- UAV inspection systems to autonomously create a 3D texture model of an asset
- Development of new industrial automation capabilities
- Innovative new optical hardware and advanced image processing techniques for interactive 3D remote visual inspection
- Developing “Inspect-while-you-weld” capabilities
- Bio-acoustics



Working with Industry Case Study: Spirit AeroSystems (Europe)

To meet **market demand** and **double productivity** Spirit AeroSystems need process times across the entire operation will need to be reduced – including inspection...

Results are potentially
transformative for manufacturing
inspection → 60% reduction in
inspection times



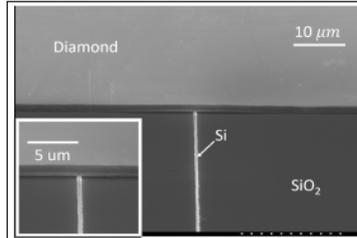
“Centres such as the AFRC are vital to bridging the gap between academic research and industry: this project shows the benefits of doing exactly that.”

David Watson: Senior Manager at Spirit AeroSystems (Europe) Advanced Technology Centre

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Strathclyde Approach: Collaborative Centres

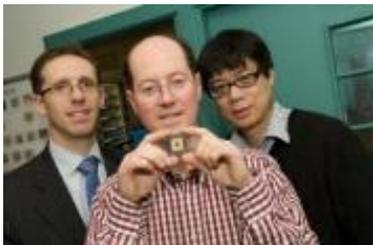
Institute of Photonics



Established 1995 as a dedicated R&D unit and cost centre within the Science Faculty, having the remit to 'bridge the gap' between academia and industry in photonics

3 professors: Keith Mathieson (Director)
Martin Dawson (Director of Research)
Alan Kemp (Fraunhofer/RAEng Chair)

Broad range of activities spanning solid-state lasers, semiconductor optoelectronics and bioscience



Spun out mLED Ltd. on micro-LED technology in 2009
Acquired by Facebook/Oculus in 2016

Cumulatively in excess of £25M of funding as principal investigators from EPSRC alone

Over 100 contracts with industrial partners

Central role in the formation of the UK's first Fraunhofer Centre, mLED Ltd, CST Ltd and Photonix Limited

Three Royal Academy of Engineering Research Fellows and a Fraunhofer/RAEng Chair in Advanced Laser Engineering

60 staff and students with a principal investigator complement of 10

Graduated over 70 PhD-level students, many of whom now work for local industry

12 photonics laboratories and a clean room microfabrication facility (totalling over 1000m²) in the University's flagship Technology & Innovation Centre

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Strathclyde Approach: Collaborative Centre Evolution

Fraunhofer Centre for Applied Photonics

- Technology delivery and custom R&D organisation focussing on photonics, est. 2012
- A world-leading translational centre of experts, with fully equipped labs and workshops.
- 26 staff and a further 16 PhD/EngD students, growing every year...
- Photonics- lasers, laser systems, LEDs, Optics, everything to do with light.
 - Applied R and D projects directly for companies and collaboratively with companies.
 - Either direct cash contracts, or working in collaborative projects funded by InnovateUK, ESA, H2020 etc.
 - Many repeat customers in : Energy, Defence, Lifescience, Environmental monitoring, Space, Quantum Tech.
 - Fraunhofer CAP delivers bespoke photonics technology, demonstrators and prototypes for: metrology, sensing, communications, imaging, instrumentation
- Over 100 funded projects to date (total project value ~£35M) with several dozen industry partners from SMEs to multi-nationals.
- 50% of work is with the photonics industry in Scotland, which has £740M annual turn-over of which £380M is exports



Power Network Demonstration Centre (PNDC)



- £45M / 10 Years/ 10:1 gearing
- Scale, pace, expertise
- International membership and International research cluster
- Enhanced measurement, frequency and voltage control with a unique fault throwing/ disturbance feature
- Real 11kV and LV distribution networks, which are flexible
- Capability to research, test & demonstrate hardware, software & integrated systems solutions in a safe, controlled environment



Asset Management



Communication
and Systems
Integration



Network and
Demand-Side
Management



Power Electronics
and Distributed
Energy



Protection and
Control



Sensors and
Measurement



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Strathclyde Approach: Collaborative Centres

Advanced Nuclear Research Centre (ANRC)



ANRC is a world renowned centre providing research support for nuclear operations & life extension

Delivering applied research solutions to enhance Members business needs:

- Governance: Led by industry for industry
- Research: Common 'core' programme & Member-specific projects
- Primarily mid-level TRLs – Draws lower TRL research from the best source - globally
- Technology Fore-sighting
- Direct support / knowledge exchange

Industry led club model

- Industry Board and Technical Board
 - Tiered membership, T1s define the challenges, T2s provide support and are built into the solutions 6:1 + gearing
- University targets matching research funding and partners;
Includes Canadian Universities & Canadian funding

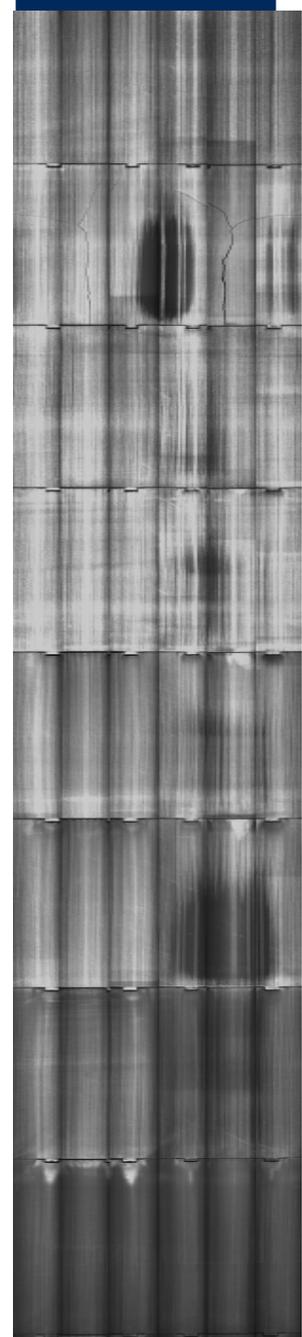
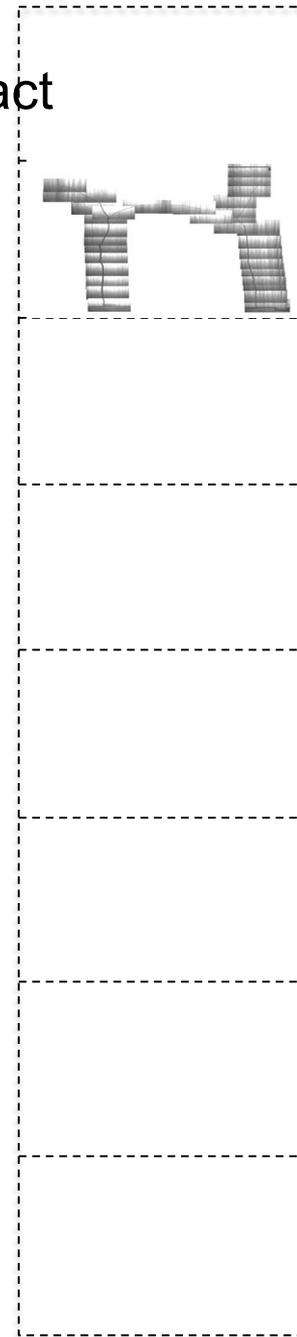
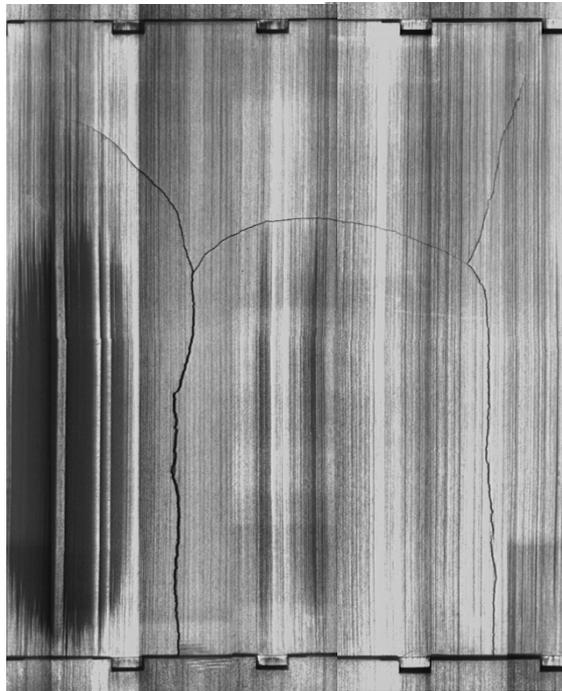
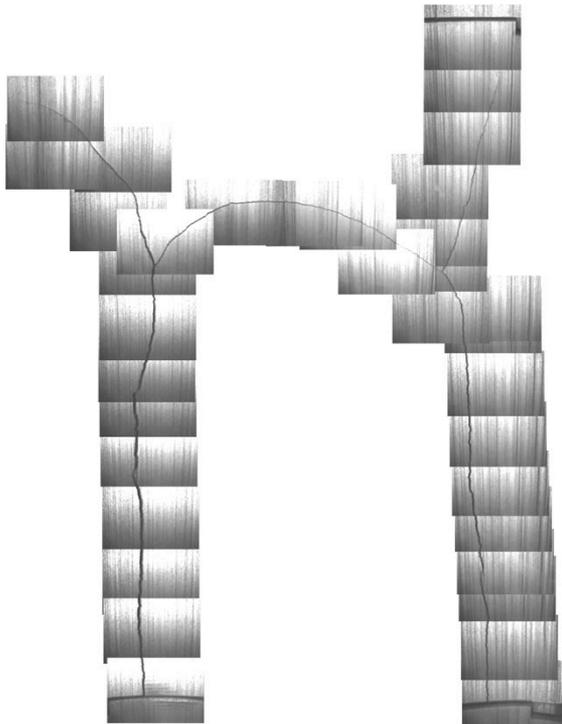


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Strathclyde Approach: Collaborative Centres - Impact

Advanced Image Processing – “Chanorama”

- Manual Method: A **full working day** to produce approx. **3-4%** of full channel image
- Automatic Method: Around **20 mins** to produce **100%** of 8 layers



Continuous Manufacturing & Advanced Crystallisation (CMAC)

To transform manufacturing efficiency, effectiveness, costs and flexibility
in pharmaceutical manufacturing.

Targets:

- 70% reduction in Capex for new plants
- Elimination of Intermediates
- 60%+ reduction in plant size
- Enabling new services and products: personalised medicines

Impact:

- Support - 24 members, projects with 150 companies
- Future skills and employees – 160 MScs and PhDs so far
- Translation – driving a demonstration & deployment centre
- £4M Industry fees have created a £100M programme for industry
- Targets Achieved and exceeded in some cases

Co-created with industry to address key manufacturing challenges and skills needs



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Strathclyde Approach: Collaborative Centre Evolution

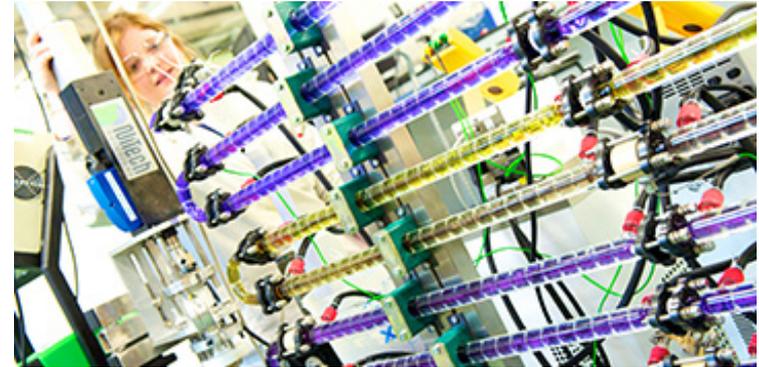


Medicines Manufacturing Industry Centre (MMIC)

CMAC: Concept to Demonstration

MMIC: Demonstration to Deployment

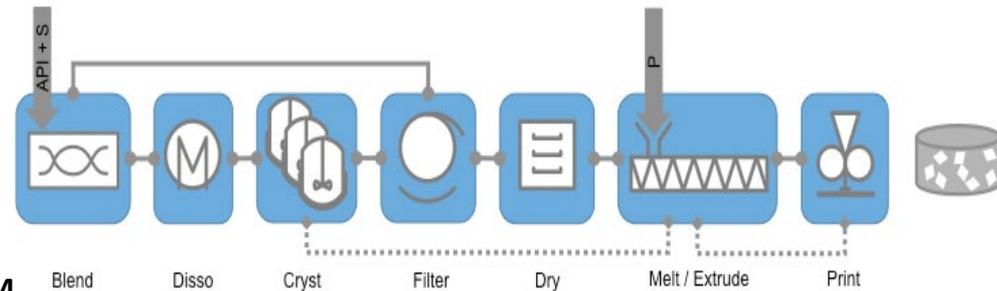
What: Industry led translational research centre allowing scale up and demonstration of continuous pharmaceuticals manufacturing. Open access.



When: Launched 2018

Where: Inchinnan, Glasgow, UK

Funding: £55M: Innovate UK £13M, SE £15M, GSK £7M, AZ £7M, Johnson Matthey, Pfizer, Merck, Lilly, Bayer and Siemens are in discussions.



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Strathclyde Approach: Collaborative Centres

Technology and Innovation Centre (TIC)

- World-class centre for translational & collaborative Research and Development **accelerating innovation with Industry**
- Opened by HM Queen Elizabeth in 2015
- **Advanced technology support:** £150M building and R&D equipment for industry
- **Adding scale to accelerate impact:** Co-location of 750 University + Industry Researchers, Engineers, Students and Project managers
- **Connecting industry to expertise:** £125m+ in international, collaborative R&D programmes
- **Improving accessibility:** Public, industry and research spaces



Entrepreneurial
Scotland...



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Strathclyde Approach: Collaborative Centre Evolution

Glasgow City Innovation District & TIC Zone Phase 2

- **Intensify innovation activity** across Glasgow City Innovation District (GCID), the region, nationally and internationally;
- **Create a dynamic hub for innovation networks** of companies, organisations and academia across;
- **Create a high intensity TIC Zone** to attract translational organisations, innovators and entrepreneurs, helping companies achieve their strategic goals.



- **More than double the footprint of TIC & Inovo** from c141,000 sq ft to c300,000 sq ft;
- **Generate significant economic impacts** at the UK level.

Advanced Forming Research Centre (AFRC)

To transform manufacturing efficiency, effectiveness, costs and flexibility
in forging and forming manufacturing



- £250M+ raised for industry projects
- 10:1 gearing achieved for members
- 35 Global members
- 350 customers
- 520 projects helping industry, e.g. reducing manufacturing times by 90%
- Scale, pace, expertise
- Part of UK Advanced Manufacturing Catapult
- Largest forming research centre in Europe
- Future employees, 136 staff
- PhD, EngD, MSc and CPD programmes.

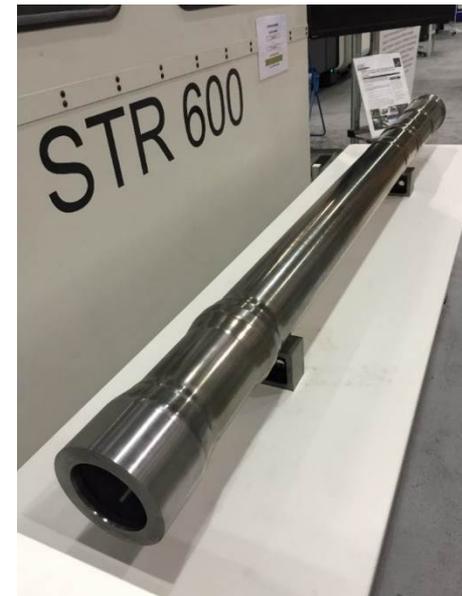
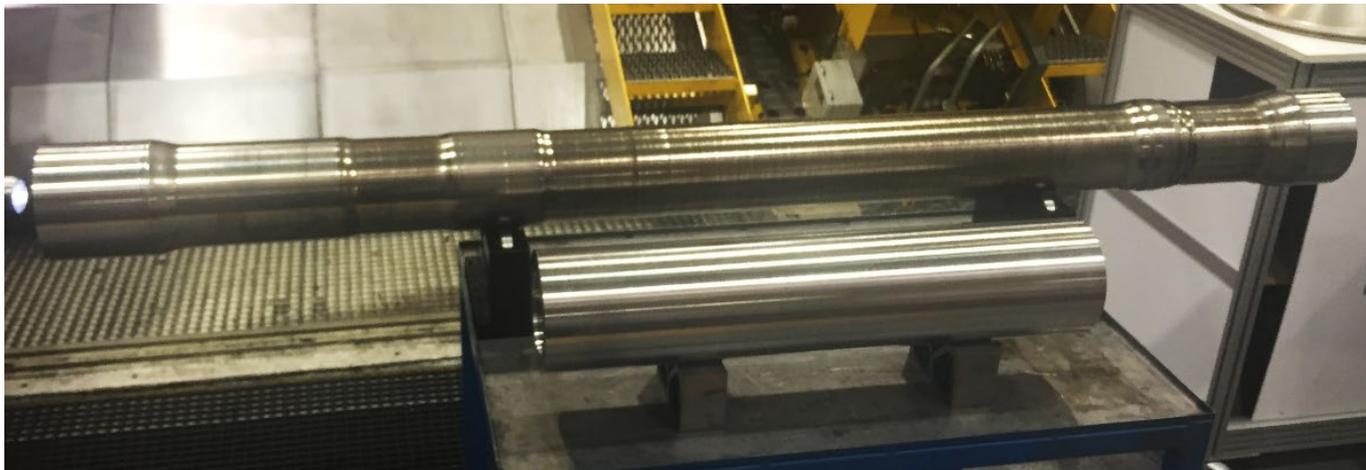


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Strathclyde Approach: Collaborative Centres - Impact

Flow Forming: Creating near net-shape components with optimum use of input material

- Main aim:
 Demonstrate process capability to flow form a full scale aero shaft.
- High strength super CMV steel tube preform
- Current manufacturing machined from billet **~20% material utilisation**
- Flow form manufacturing route **~66% material utilisation & reduction in manufacturing time**

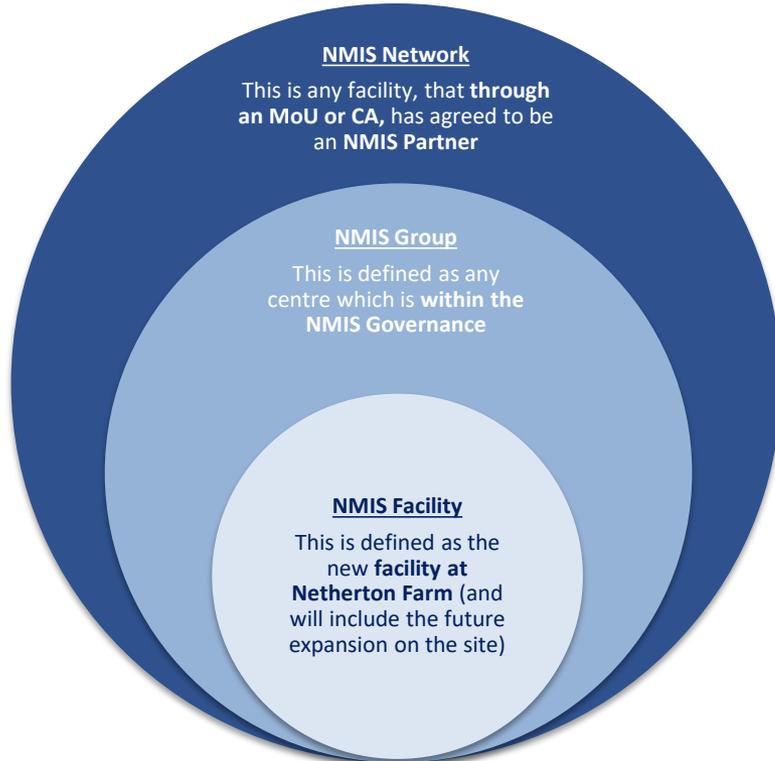


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Strathclyde Approach: Collaborative Centre Evolution



National Manufacturing Institute Scotland is an industry-led international centre of manufacturing expertise where industry, academia and the public-sector support bodies work together to transform skills, productivity and innovation making Scotland and the UK a global leader in advanced manufacturing.



NMIS Network is the collection of NMIS Partners (Universities, Colleges, Research Centres etc), who through a Memorandum or Understanding (MoU) or Collaboration Agreement (CA) have agreed to be part of the NMIS delivery. The NMIS Network will also provide advisory input to the NMIS Strategy (through the Outreach Forum) as this will be a representative group of multiple sectors and technology areas.

The **NMIS Group** includes other research centres which are within the NMIS Governance but are not necessarily co-located. This currently includes the Advanced Forming Research Centre (AFRC) and the new Lightweight Manufacturing Centre (LMC).

The creation of NMIS will be funded through a £48M Scottish Government investment, £8M contribution from the University of Strathclyde and £9M for the Lightweight Manufacturing Centre (LMC)

This funding is primarily to set up the new **NMIS Facility** at Netherton Farm, near Glasgow Airport, with a suite of advanced manufacturing equipment, as well as mobilising an expertise team of resources to support businesses through project delivery.

NMIS is the totality of the facility, the NMIS Group and the NMIS Network. With all elements present, the optimum solutions to meet industry needs - transforming skills, productivity and innovation - can be developed and delivered in partnership.

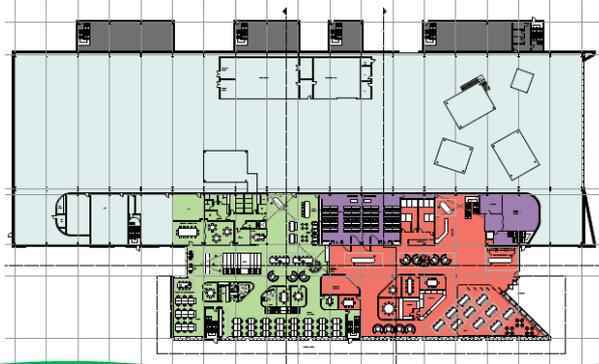
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Strathclyde Approach: Collaborative Centres

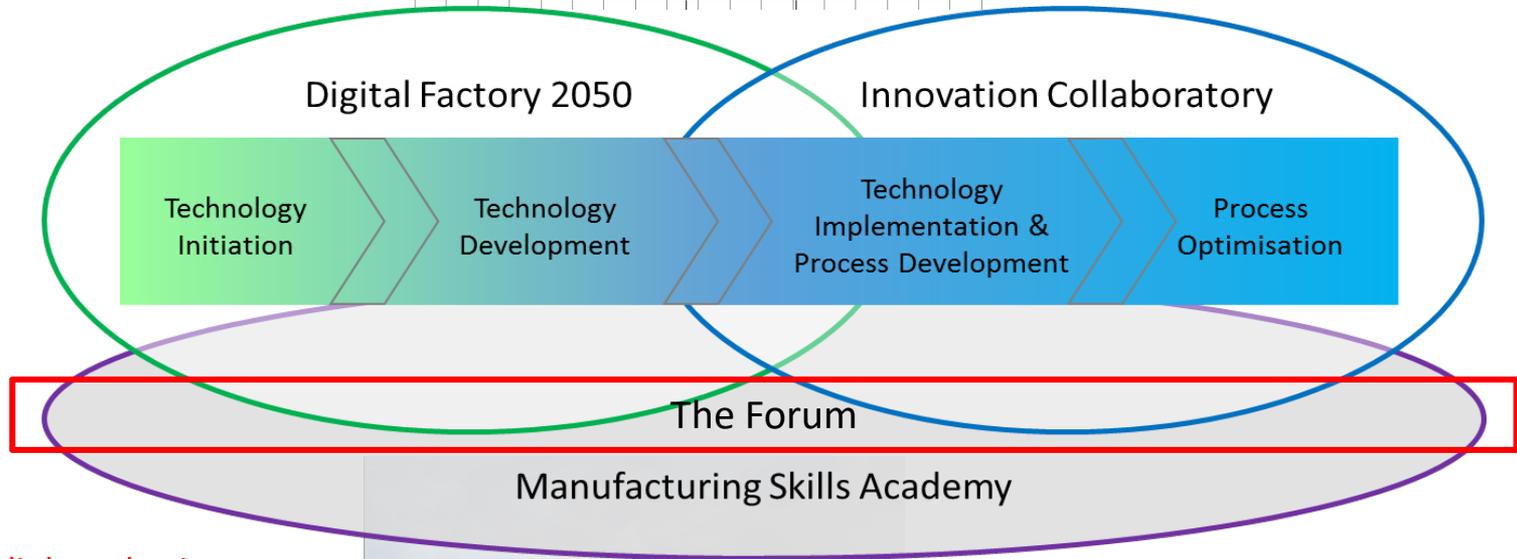


National Manufacturing Institute Scotland Facility

DF2050: Collaborative manufacturing research, technology & solution development, drawing in supply chain partners, SMEs and centres of excellence



IC: Manufacturing technology demonstration, application and process development



The Forum: Providing links to business support, to the One Scotland Partners & to external organisations such as schools, Zero Waste Scotland, Scottish Institute for Re-Manufacture etc



MSA: A hub for advanced manufacturing skills and education linking to existing and future providers

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- So, What's the Problem?
 - The “Valley of Death” is also a ‘valley of opportunity’ for translational research centres
- The ‘Triple Helix’
 - Aligning research capabilities with Industry needs and Government policy creates the conditions which enable impact
- Approach to Collaboration: Creating Impact at Scale and Pace
 - Translational Centres of Research Excellence provide the environment for Academia and Industry to work together (supported by Government) to solve real challenges and make a difference