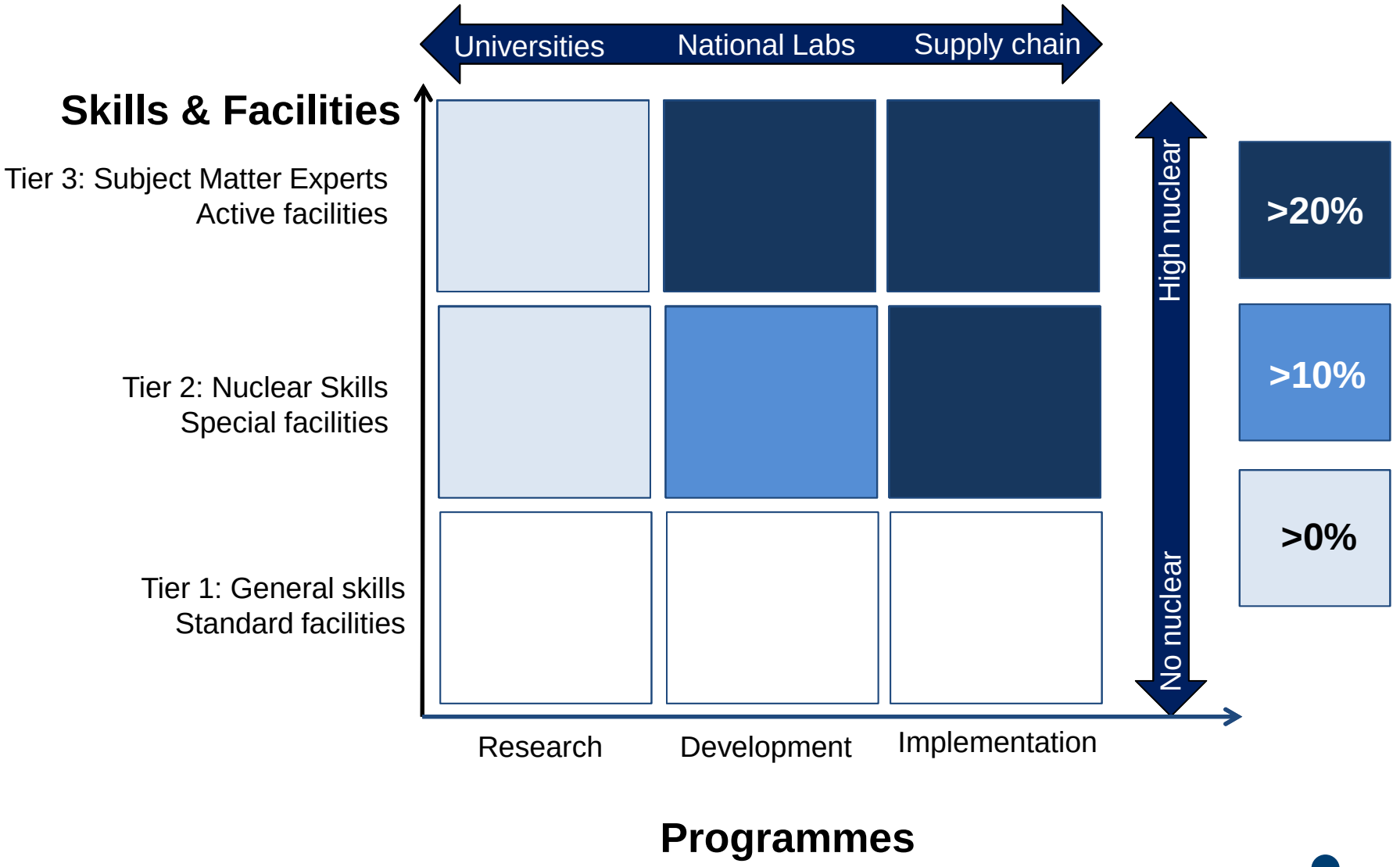
NATIONAL NUCLEAR LABORATORY

NNL Research Programmes

Mike Angus

NNL Capability



S&T Programmes

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- Deliver impactful science, technology and engineering
  …that drives impact and innovation into national programmes

  - Technical Quality: A Top 10 National Laboratory
    - Enhance quality and grow reputation through 'technical quality' training and mentoring, journal publication, and international engagement.

  - Technical Focus: Increase R&D programmes by 40%
    - Grow R&D in areas that play to NNL's skills & facilities, drive innovation into national programmes and maintain the UK's strategic nuclear capability.

  - Aggressive Innovation: 25 Case Studies and measures of impact
    - Establish a growing track record of innovation by bridging academic research and non-nuclear technology to the technical challenges of national/international nuclear programmes, inc. *via* SMEs.

IR&D Programmes

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- Entrepreneurial - £400k per year
  - Introducing new products and services and creating IP.
  - Approaching 600 ideas have been contributed.
  - Payments of up to £25,000 per invention.
  - 3 stage gates aimed at achieving TRLs 3, 6 and 9.
- Signature - £600k per year (plus additional scope)
  - Nuclear Energy –Zara Hodgson
  - Waste Management, Decommissioning & Disposal – Mike Harrison
  - Security & CBRN – Jeremy Edwards
- Strategic - £2000k per year (by re-investment of EBIT)
  - Significant impact through scientific breakthrough in areas aligned with, but not part of a national programme.
  - Typical projects will be £50-150k per year, multi-year
  - Collaborations, impact and reputation through publications
  - Themes in 2014-15 are “Nuclear Energy” and “Legacy Waste and Decommissioning”

Why Innovate?

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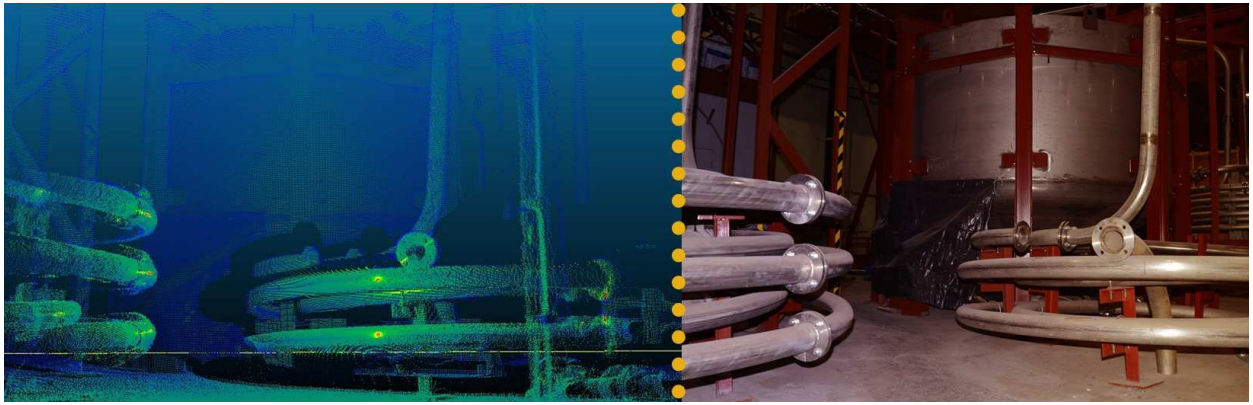
- Engine for UK economic growth
  - Including Exports of new technology
- Deliver value for customers
  - Reduce cost, introduce efficiencies
  - Accelerate programmes
  - Provide solutions
- Opportunity for personal growth

The "NiV Separator" – an innovative approach to radiochemical analysis developed by a collaboration between NNL and MicroLab Devices Ltd

Who funds Innovation?

- NNL IR&D
- Joint funding, collaboration
- NDA / DECC / Innovate UK (aimed at SME's, "Developing the Nuclear Energy Supply Chain")
- Regional Growth Fund (aimed at SME's, e.g. Innovus (NNL/UoM) in Cumbria)
- Research Council / Industrial Collaborations (e.g. DISTINCTIVE)
- Sellafield Ltd (proposed "Game Changers" programme, SL-NNL Framework rebate)
- Government (e.g. Nuclear Fuel Centre of Excellence)
- EU Programmes



NNL Miniscan – a laser-scanning device, developed by Createc Ltd, that has added additional capability to NNL's service provision to Sellafield Ltd

Strategic Projects

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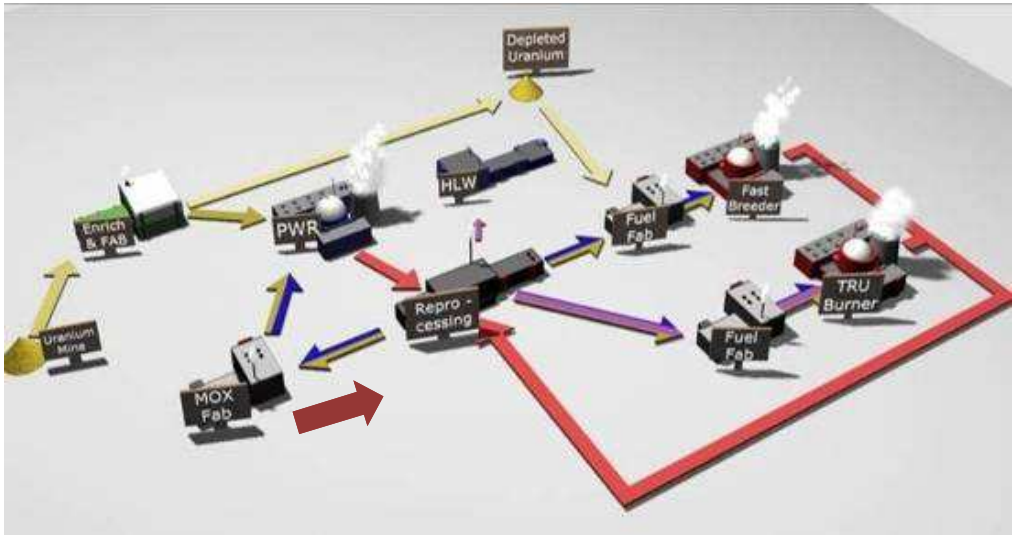
Fuel Fabrication:

•Accident Tolerant Fuel

•3D Printing



Waste Management & Decommissioning:

•Thermal Treatment of ILW

•Remote Characterisation (Photonics)

•Colloid Behaviour

•Biogeochemical Research

•C-14 in Reactor Graphite

•Decommissioning Academic Hub

•Decontamination

Thermal Reactor Operations:

•Plant Lifetime Extension & Degradation of Cladding

•Spent Fuel Storage & Disposal

•Windscale PIE

•Anti-neutrino monitoring

•Microreactors

•Reactor chemistry & corrosion

•Nuclear data (FISPIN)

Advanced Separations & Recycle:

•Aqueous

•Pyrochemical

Fast Reactor:

•PIE Methods

•Fuel Performance Modelling

Cross-cutting: Immersive and Augmented Design Modelling, Fuel Cycle Scenario Assessment, Radiation Science at DCF, Nuclear Forensics, Public Engagement, Smoothed particle hydrodynamics, Integrated Nuclear Data Environment

University Strategy

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- ***1. Nuclear Industry Research Alliance***
- To work together to enhance the sector's engagement with the academic base, build collaborative programmes and better leverage Government investment through the Research Councils and Innovate UK.
- ***2. Academic Research Networks***
- Establish a series of Academic Research Partnerships in strategic areas of relevance to National Programmes.
- Decommissioning Academic Hub with SL
- Advanced nuclear modelling with EDF Energy.
- ***3. NNL University Research Partnerships***
- Costed 5-year programmes (NB 11 new PhDs in 2016)
- ***4. NNL Senior-Visiting Fellows***
- Senior Visiting Fellow (SVF) programmes

Why work with Universities? DISTINCTIVE score so far

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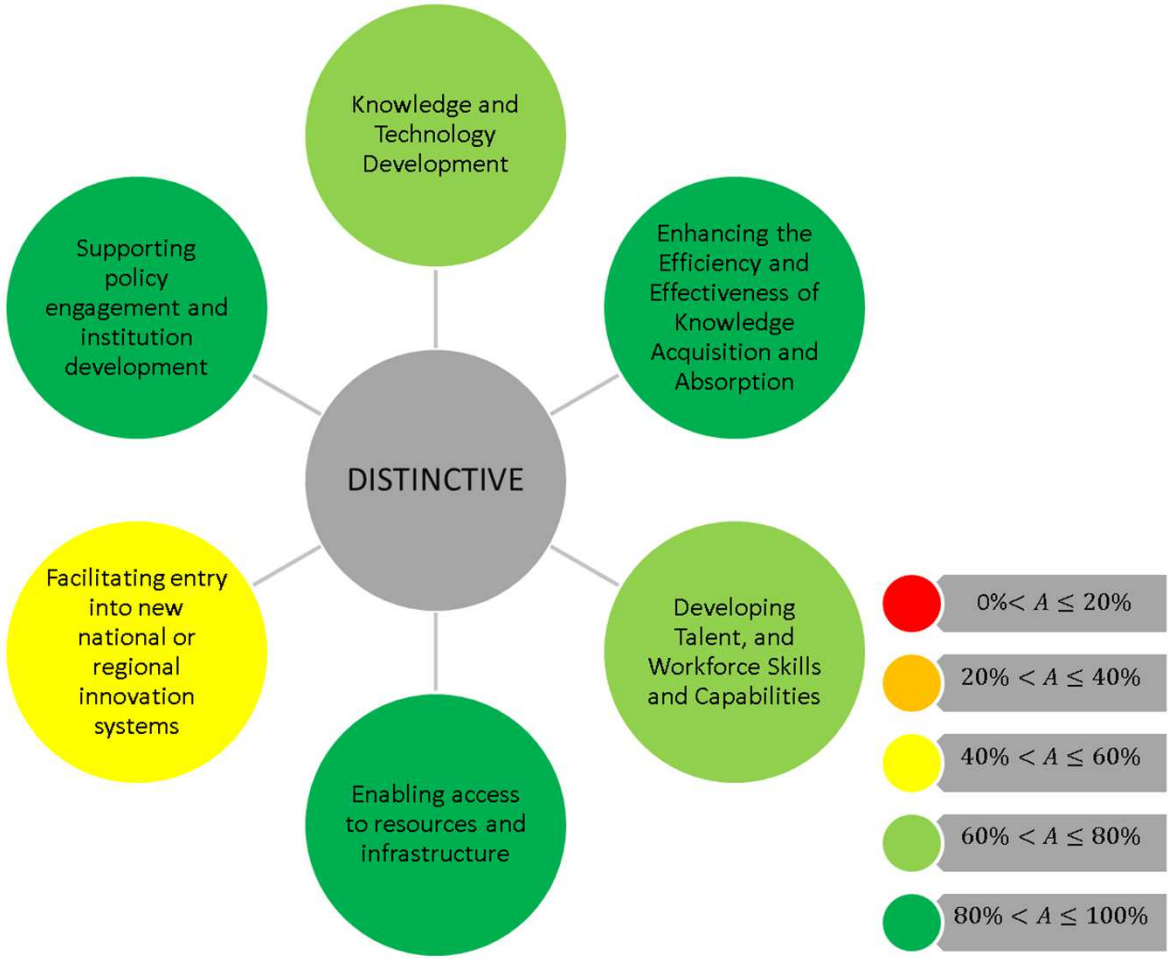

Facilities

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- Central Laboratory Phase 2 (alpha handling) now active
- Phase 3 Programme ongoing (shielded cells) ongoing
- User Access Team
- Sir Henry Royce Institute for Advanced Materials Reserch
- National Nuclear Users Facility
- New Programmes
  - NIRAB
  - Joint Research and Innovation Centre (with China)