

Industry view on current and future skills needs for NDT and Vision for NDT education in Scotland

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Presentation Overview

- How education feeds into NDT Engineer development
- Challenges facing NDT industry
- Industrial perspective on NDT Education
- Current educational options
- A view on future educational opportunities and philosophies
- How industry can help support and shape future of NDT-relevant education
- Conclusions and suggestions for way forward



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Education Pathways for NDT Technical Workforce

School Education: National 4, National 5, Highers and Advanced Highers

Apprenticeship

College

University

Day
Release

Graduate
Apprenticeship

Vocational
Training in
Engineering
Disciplines

Engineering Disciplines
Undergraduate
Degrees

Postgraduate
Degrees

NDT Training
Provision

In-House
Training

Research
Doctorates

Valuable Team Member in NDT Industry



What challenges are we facing?



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Aging Workforce

- NDT has a skewed demographic with a significant percentage of technicians nearing retirement age
- Leaving a gap in experience and knowledge



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Meeting Current Needs

- Employer and ISO 9712 NDT Training and Certification
- Scottish NDT Apprenticeship
- NDT Graduate Apprenticeships
- Are these meeting industry needs?



NDT of the Future

- Tech revolutionises the industry but requires constant learning and adaptation
- How do we grow skilled personnel for the technology of the future from academia to industry?

Industrial NDT Qualification and Certification

- NDT Qualification and Certification based on the following:
 - Industrial Experience
 - Training
 - Vision Requirements
 - Examinations
- Third Party Certification (ISO 9712, PCN, CSWIP etc)
- Employee Based In-house Certification (SNT-TC-1A, CP-189, EN 4179, NAS 410 etc)



Third Party & Employer Based Certification



- Third Party Certification (ISO 9712, PCN, CSWIP etc)
 - Globally standardised central certifications
 - Independently awarded verifiable
 - Technician owned certification
- Employee Based In-house Certification (SNT-TC-1A, CP-189, EN 4179, NAS 410 etc)
 - Tailored to meet company needs
 - Company owned certification
 - Certification integrity is only as good as companies' commitment to NDT

NDT Technician Apprentices



- Current Schemes offered by EAL and ECITB
- 4-year duration - education based on Fabrication and Welding with an NDT pathway
 - SVQ 2 Performing Engineering Operations at SCQF Level 5
 - NC in Welding & Fabrication at SCQF Level 6
 - SVQ 3 Technical Services Non-Destructive Testing at SCQF Level 6
 - HNC in Welding & Fabrication at SCQF Level 7
- Not linked to PCN certification or BINDT
- English Scheme more in line with Employer needs

NDT Graduate Apprenticeships

- BEng (Hons) Engineering: Design and Manufacture degree through the University of Strathclyde
- Supported by BINDT
- Will develop professionally qualified engineers eligible for IEng level membership.
- Employers can nominate existing employees or newly recruited candidates who will then be considered for admission to the programme
- Fully funded by the Scottish Government through the Scottish Funding Council and Student Awards Agency Scotland ([SAAS](#))



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Are we meeting Current industry needs?



- Industrial NDT Qualifications
 - Accelerated work programmes now offered by training providers to claim 50% of total work experience
 - Online Training Courses now available
- NDT Technician Apprenticeships
 - HNC in Welding & Fabrication at SCQF Level 7
 - English scheme is more in line with current needs
 - How can it be adapted to coincide with the PCN scheme and advances in technology
- NDT Graduate Apprenticeships
 - Supported by BINDT
 - SAAS Funding Available
- How do we plan to meet future industry needs?

Current Education Provision - focus on Scotland

- Apprenticeships
- Colleges
- Universities
- Commercial NDT Training Courses

Institute Name	City	Course Name
The British Institute of Non-Destructive Testing	Northampton	NDT (Non Destructive Testing)
AIS Training	Tyne & Wear	NDT (Non Destructive Testing)
Argyll Ruane Institute of Mechanical Engineers	Sheffield	NDT (Non Destructive Testing)
The South West School of Non Destructive Testing	Cardiff	Level 3 NDT
International Studies	London	Introduction to NDT
Fife College	Dunfermline, Fife	The Importance of NDT in Quality Control
Belmont Quality Services	Leeds	NDT

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Current Education Provision - focus on Scotland

- Apprenticeships
- Colleges
- Universities
- Commercial NDT Training Courses

Top NDT (Non Destructive Testing) Institutes in the UK

1. The British Institute of Non-Destructive Testing, **Northampton**
2. AIS Training, **Tyne & Wear**
3. Argyll Ruane Institute of Mechanical Engineers, **Sheffield**
4. The South West School of Non Destructive Testing, **Cardiff**
5. International Studies, **London**
6. Belmont Quality Services, **Leeds**
7. Fife College, **Dunfermline, Fife**

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Current Education Provision

- **Apprenticeships**
 - Colleges
 - Universities
 - Commercial NDT Training Courses
-
- Employed through industrial organisation
 - Training directly relevant to company service provision or operational requirements
 - Taking school leavers and developing base technical skillset to contribute to NDT team
 - Graduate Apprenticeship enables staff to acquire advanced knowledge/understanding of a professional engineer and crucially, while contributing to company operations

Current Education Provision

- Apprenticeships
 - **Colleges**
 - Universities
 - Commercial NDT Training Courses
-
- General engineering courses, albeit “Welding & Fabrication” has direct relevance
 - One or two year duration
 - Practical experience, but generally in laboratory
 - Preparatory for NDT career and would require additional specific training

Current Education Provision

- Apprenticeships
 - Colleges
 - **Universities**
 - Commercial NDT Training Courses
-
- Undergraduate degree courses provide theory and laboratory training in relevant disciplines of engineering (some science subjects may also be routes into NDT careers)
 - Postgraduate degree education can be more targeted at an industrial sector and may include elements of NDT within the curriculum
 - Postgraduate research degrees can focus on industrially relevant topics and be directly engaged with NDT applications, albeit typically with a long-term implementation outlook
 - A number of universities have NDT research active groups, which engage with industrial partners
 - Albeit only a few in Scotland

Current Education Provision

- Apprenticeships
 - Colleges
 - Universities
 - **Commercial NDT Training Courses**
-
- Career development/advancement through upskilling
 - Many vendors, as many NDT technologies within sector
 - Professional NDT certification through this route
 - Hybrid approaches to training with theory delivered online, followed by in-person practical training on site

IMechE Fife NDT + Fife College

NDT training, examinations and consultancy services.

Specialising in providing top-tier services to clients in the Scottish region.

- 60+ training courses covering all core NDT methods, including VT, MT, PT, UT, PA, ToFD.
- Level 1, 2 and 3 initial, recertification and refresher courses.
- Auditing, procedure writing, written practice development, acting as a Responsible Level 3, expert witness, bespoke training and examinations.
- Training and examinations to PCN (ISO 9712), EN4179/NAS410 and SNT-TC-1A.



Strathclyde Graduate Apprentice: NDT Module

Graduate Apprenticeship Engineering: Design and Manufacture (GA EDM) degree.

Launched in 2017 and now triple accredited (IET, IED and IMechE).

Applications and Principles of Non-Destructive Evaluation

10 Credit module
Delivered as option in 4th year

- Eddy Current Testing
- Ultrasound
- Laser Ultrasonics
- Radiography
- Automation and Integration

Upskilling example through NMIS

Continuous Professional Development

Non-destructive testing techniques and applications



- 3-day course funded by the Scottish Government through its flagship programme, National Transition Training Funding (NTTF)
- Course is designed for
 - Engineering professionals who are planning to change their career
 - industrial professionals active in the field of NDT and willing to expand their knowledge
 - industrials interested in familiarizing themselves with recent advances in NDT

Remote Learning

- Online University Courses
- Upskilling Workshops
- Online Individual/Specific Modules

Provide ability for individual to learn and potentially improve job prospects.

However, challenging to provide critical practical aspects associated with the majority of NDE industrial applications.



Non-Destructive Testing Level II Full Course | NDT Course

Learn all the NDT level II testing methods and earn a valuable certification. Quizzes and interview questions included



Non Destructive Testing Methods (NDT Process)

liquid Penetrant testing, Eddy current test, Ultrasonic Testing, Radiography, Magnetic Particle Method, Leak Testing, NDE



Ultrasonic Testing from Basic to Advanced in NDT Level II

Become an expert in ultrasonic testing technique

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Focus from Engineering Organisations

- IMechE has several initiatives looking to improve quality of engineering related educational provision aimed at school pupils.
- Education is one of five strategic themes in the *IET Strategy 2030*.
- IEEE had a series of articles around *The Future of Engineering Education* (IEEE Potentials, March/April 2021).
- RAEng *Engineer 2030* aims to enable transformative change to the UK education and skills systems.
- Engineers Without Borders provides a vision through which engineering educators can empower future practitioners to deliver sustainable, ethical and equitable outcomes.
- We have heard earlier in this seminar, that BINDT is also actively looking towards for future education provision specifically for the NDT sector.

Requirements for the Future NDT Technical Workforce

- There should always be a demand for apprenticeships and upskilling courses/modules.
 - However, will the skillset requirements change or diversify to match the technical demands associated with NDE 4.0 (and beyond)?
- Practical skills should always be important.
 - However, the ability to operate in a digital environment will become increasingly important.
- Collaborative Human-Robot working environments will necessitate new operating skills and new health & safety criteria.
 - Can we envisage a time when human operators will not be required?
- Advancing NDT approaches (sensor technology, automation, AI, etc) to facilitate NDT as new materials and systems are developed.
 - Has always been the case, but likely to just get more and more challenging.
- What role will Ethics play in NDT 4.0?
 - Important from human-machine perspective, as well as the critical safety-related impact from NDT related to protection of society and the environment.

Educational Approaches for Future NDT Skillset

- Development of more active learning modes of education
 - Challenge/Project/Work based education: problem based, contextualised learning approaches
- Hybrid/Blended learning approaches facilitate accelerated and flexible training
- Combine Virtual Reality with high-quality online training material to provide a route to upskill NDT personnel in the future
 - VR is in the market place now, but opportunities are vast
- Each team (if not each person) will require expertise in digitisation and utilisation of AI to ensure that future NDT inspection approaches are fully compliant with all appropriate codes and safety standards
 - What qualifications will be required in the future? Level 3+? Level 4?
- Embed NDT concepts into Materials and Design courses to ensure next generation systems include a provision for accessible inspection approaches
- Empower future NDT practitioners to deliver sustainable, ethical and equitable solutions

Role of Industry in Provision of Future NDT Education

- Who is best placed to keep up with NDT advances to ensure the future workforce is qualified in latest/most appropriate techniques – I'd say industry!
- How can industry lead in terms of future provision of education focussed on NDT?
 - Provide steer through organisation like BINDT – make your voice heard.
 - Direct engagement with Universities, Colleges and training service providers to identify emerging opportunities which would benefit industry.
- Use projects to introduce NDT into curriculum – but must be able to support through staff time as industrial supervisor.
- Consider options for internships to bring prospective future employees into your organisation.
- Some degrees have placement opportunities – again, necessitates a time commitment.
- Engage with research teams working in the field of NDT. This can be through bilateral projects, studentships or larger collaborative projects. Usually longer term both in terms of potential staff relations and technology realisation.

Final Words....

- Important to engage with young people during their education journey and promote NDT as a career option.
- Is Scotland lagging behind rest of UK and Europe?
 - Challenging to have bespoke HE courses directly targeting NDT in Scotland.
- Industry can make representation to HE to inform institutions of future skill requirements.
 - For example, through organisations like BINDT or directly via Industry Advisory Boards
 - However, should note that decisions will be based on commercial criteria
 - Alternative would be to see how current curricula match with future demands or through project supervision
- We need a strategy on how to harness the power of AI to support future NDT training approaches, as well as in the delivery of NDT operations – led by BINDT?
- Integrating NDT throughout the Scottish educational cycle would not be practical, but we do need an integrated approach to ensuring sufficient touch-points to ensure messaging around importance of NDT and careers opportunities is communicated.
- World is analogue, but future is digital!
- Final point, as we innovate (in the near future according to the Terminator films), will self-repairing materials remove requirement for NDT?



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