Workforce Foresighting Hub

Enabling Future Fuel Ecosystems at Airports

Workforce Foresighting Hub findings report in collaboration with the Connected Places Catapult.

Date: 21/08/2025

Acknowledgements

The Workforce Foresighting process integrates data from the following international data sets:
IfATE – Institute for Apprenticeships and Technical Education, England
ESCO – European Skills, Competencies, Qualifications & Occupations, EU
ONet – Occupational Networks Online, USA

In accordance with licence and publishing requirements of these organisations for the use of their data sets, the Workforce Foresighting Hub team states that –

Any errors, omissions and incorrect data are the responsibility of the Workforce Foresighting Hub team, and all queries should be addressed to info@iuk.wf-hub.org

The method and process used in the Workforce Foresighting process is under development and there may be errors and omissions in the data provided.

This report was produced following workshops undertaken February – May 2025 using the data set and tools available at that time.

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Executive Summary

Executive Summary

This report outlines findings from the Workforce Foresighting cycle titled "Enabling Future Fuel Ecosystems at Airports". The study is sponsored by London Luton Airport and conducted by the Connected Places Catapult in collaboration with the Workforce Foresighting Hub, an Innovate UK initiative.

Workforce foresighting is a systemic approach to planning ahead and anticipating future skills and capability needs associated with new technologies and government transformation targets. It involves identifying and understanding the skills required for tomorrow's jobs, ensuring our education and training systems are prepared so that our workforce is ready to adopt new technologies and support future industrial growth.

This report sets out the findings of the workforce foresighting study and suggests the next recommended actions required by various stakeholders to ensure a workforce is created that is prepared to effectively implement these new technologies in the sector.

The Challenge

The UK aviation sector faces an unprecedented transformation driven by national Net Zero targets and the imperative to adopt alternative fuels, including hydrogen, electric power, and Sustainable Aviation Fuel (SAF). This transition presents challenges that extend far beyond simple technology adoption:

Infrastructure complexity demands a comprehensive redesign of fuelling systems, storage facilities, and safety protocols to accommodate multiple fuel types, each with distinct handling requirements and operational characteristics. The shift from conventional aviation fuel to hydrogen systems requiring cryogenic storage and enhanced safety protocols represents a fundamental operational transformation.

Cyber-physical vulnerabilities emerge as digital control systems integrate with physical fuelling infrastructure, creating new attack vectors and operational risks. These vulnerabilities become particularly acute in hydrogen systems due to their high flammability and complex storage requirements, necessitating sophisticated security measures that bridge both digital and physical domains.

Workforce readiness presents the most critical challenge, with a national shortage of specialists trained in hydrogen and SAF production, distribution, and electrical infrastructure installation. Current airport operations staff, ground handling personnel, and emergency response teams lack the specialised competencies required to safely and securely manage these emerging fuel systems.

Regulatory compliance pressures intensify through frameworks such as the Critical Entities Resilience Directive (CER) and the UK Aviation Cybersecurity Strategy, demanding new technical and safety competencies across the entire sector.

Without targeted workforce development initiatives, the deployment of zero- and low-emission aviation technologies faces significant delays, fundamentally undermining both climate objectives and economic competitiveness.

Participants and stakeholders

Employers	Educators	Technologists
Barnaby Nash – London Luton Airport	Darren Hurley-Smith - University of Kent	Tim Parker - South West Cyber Security Cluster
Nicole Walker – London Luton Airport	Lenny Koh – University of Sheffield	Matt Lees – Clyde Hydrogen
	Andrew Rae - University of the Highlands and Islands	Ash Gifford – Connected Places Catapult
	Upul Kahagala Gamage – Cranfield University	

Table 1: Participants and stakeholders

Key Findings

The most significant finding from this cycle reveals a workforce gap in cyber-physical security and fuel infrastructure capabilities across the aviation sector. Despite the urgent need for transformation, current occupational standards and training provision remain poorly aligned with future role requirements. This misalignment threatens deployment delays, regulatory non-compliance, and safety incidents without immediate intervention.

The foresighting cycle generated a set of Future Occupational Profiles (FOPs) across junior, mid-level, and senior roles. Key examples include:

Role Level	Example FOPs
Junior	Maintenance Planner, Training Coordinator
Mid-Level	Cybersecurity Specialist, Fuel Infrastructure Engineer, Sustainability Specialist
Senior	Emergency Response Coordinator, Regulatory Compliance Officer, Safety & Security Operations Manager

Table 2: Future Occupational Profiles (FOPs) across levels

These roles reflect the integration of fuel safety, digital systems, and regulatory oversight required for future airport operations.

Our analysis reveals contrasting patterns in workforce readiness:

- Optimal alignments include Emergency Response Coordinator roles matching Resilience and Emergencies Professional standards, Maintenance Planner positions aligning with Aircraft Maintenance Technician qualifications, and Aerospace Systems Engineer roles connecting with Power and Propulsion Gas Turbine Engineer competencies.
- Critical gaps emerge in most mid-level and senior positions, with roles such as Fuel Infrastructure Engineer, Sustainability Specialist, and Risk Manager showing low suitability against current IfATE standards. While cybersecurity roles demonstrate some suitability, they lack coverage of operational technology (OT) specific competencies and hydrogen safety protocols essential for sector transformation.

🔗 Workforce Foresighting Visualisation Tool[[1]]

[1] Workforce foresighting visualisation tool https://hvmcatapultforesighting.retool.com/embedded/public/e869283b-4b8a-437c-973e-64ab292e5b87?token=8953f841a9b37a93b0f3ebc5c4f68c4b

Actions Required

We strongly advocate for immediate action. We suggest the following steps:

- **Convene a Cross-Sector Working Group**
  Comprising London Luton Airport as sponsor, Connected Places Catapult as convenor, alongside IfATE, Innovate UK, relevant Catapult Centres, and stakeholders from the foresighting workshops. This group will validate findings, prioritise actions, and coordinate delivery across the Skills Value Chain.

- **Validate Future Occupational Profiles**
  Through stakeholder engagement, employer demand assessment, and strategic workforce planning alignment, ensuring FOPs reflect operational realities and regulatory requirements.

- **Establish Sector Championship**
  Through designated organisational or individual leadership to advocate for skills development, coordinate with industry bodies and education providers, and promote continuing professional development, apprenticeship reform, and curriculum innovation.

This foresighting cycle has highlighted a significant and time-critical gap in workforce capabilities required to support the aviation sector's alternative fuel transition. The deployment of cyber-physical security systems for multi-fuel infrastructure demands new competencies spanning airport operations, fuel handling, and digital systems integration.

Failure to act on these findings will result in workforce unpreparedness for future fuel ecosystem demands, delaying critical infrastructure deployment, increasing safety risks, and undermining the UK's Net Zero commitments. The compressed deployment timeline between now and 2028 demands immediate and coordinated action to ensure the sector remains competitive, resilient, and sustainable while meeting its transformational objectives.

The contrast between the sector's ambitious technological goals and current workforce capabilities represents both a significant challenge and a strategic opportunity. Success requires unprecedented collaboration between employers, educators, technologists, and policymakers to bridge this gap and position the UK as a global leader in sustainable aviation infrastructure and operations.

1 Introduction

1. Introduction

Section	Title
1.1	Background to Workforce Foresighting
1.2	Workforce foresighting - process overview
1.3	Foresighting vs forecasting
1.4	Visualisation tool

1.1 Background to Workforce Foresighting

The report "Manufacturing the Future Workforce" (Collier et al., 2020) recommended the Skills Value Chain as an approach to avoid shortfalls in workforce capabilities relating to future innovations (see Figure 1). This is the genesis of the workforce foresighting programme, which is sponsored by Innovate UK and delivered through the Innovate UK Catapult Network.

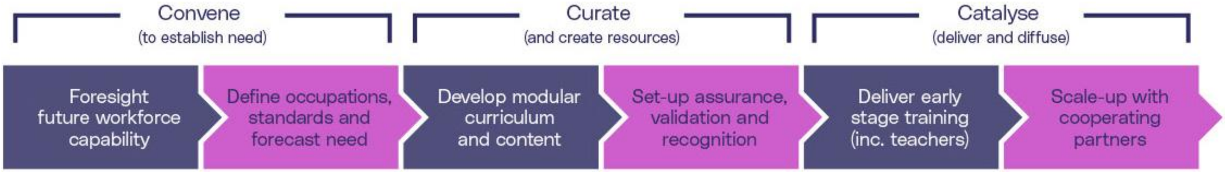

Figure 1: The Skills Value Chain

The first step of the skills value chain is to "Foresight future workforce capability": This calls for technology, industry, education, and training partners to convene using government as a focal point, to "foresight and articulate future skills need, standards and qualifications associated with emerging technologies" (Collier et al., 2020).

1.2 Workforce Foresighting - Process Overview

The core of workforce foresighting is convening three groups of relevant specialists to conduct structured, Delphi-style, facilitated workshops to capture and discuss the set of organisational capabilities that will be required to respond to and exploit technology innovation.

Organisational capabilities are captured using a bespoke classification that has been developed by the Workforce Foresighting Hub. The classification uses a structured common language to enable cross sector and cross centre collaboration and integration of data.

Additionally, the classification enables data from a number of other national and international open-source workforce datasets to be integrated through the same common language. The data is held in a cloud based "data-cube" that is dynamically growing as each workforce foresighting cycle adds to the shared data relating to future workforce capabilities.

Using cutting edge AI and Large Language Model data tools, the data-cube is used to undertake detailed analysis to 'map' future workforce capability requirements against the current education and training provision to identify where existing provision can be used and where new provision, CPD or qualifications are required.

As an agile development project, the Workforce Foresighting Hub team are constantly evolving and improving the detailed workshop process and workshop approach, but always consists of the following stages:

Considering – Clarifying the Challenge to be met (the 'what' and the 'when') and collating solutions (the 'how') as foresighting topic suggestions align with strategic priorities
Identifying – Gain clarity and consensus about the solutions to be put forward – make the case for foresighting
Preparing – The convening of specialists and scheduling of workshops
Carrying out – Run foresighting workshops with experts, collate and analyse data

Communicating – Insights, findings and recommendations gathered from all research in report
Causing action – The driving of action based on the recommendations (promoting progress down the rest of the skills value chain) built on the findings and recommendations of foresighting

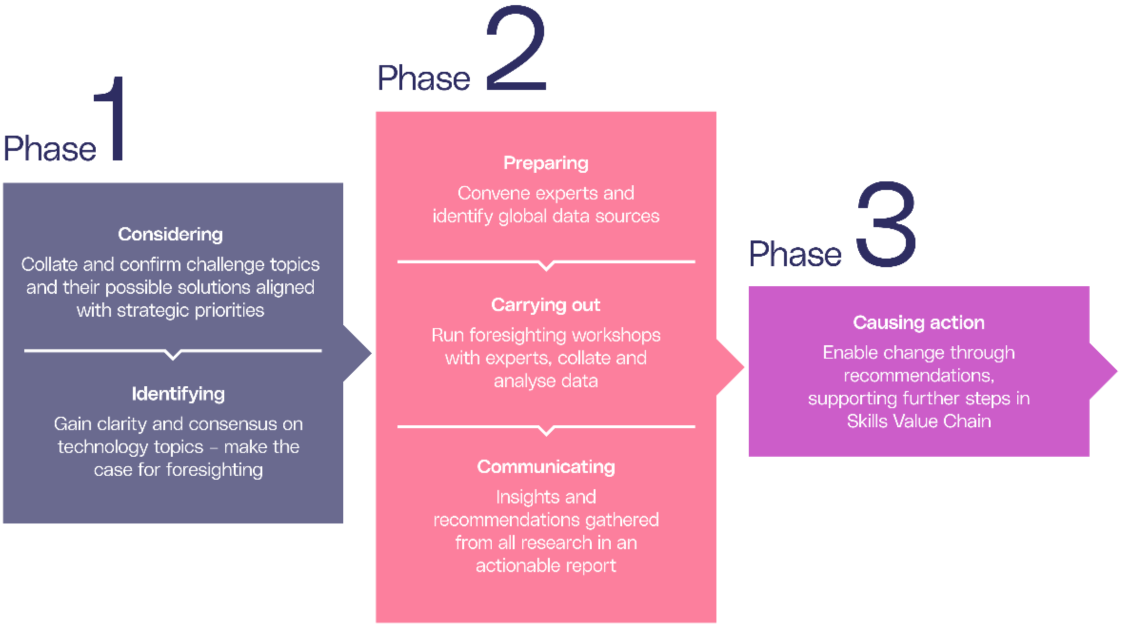

Figure 3 - The workforce foresighting process

1.3 Foresighting vs Forecasting

Although this study is focussed on workforce foresighting (capabilities required) it is important to keep in mind parallel findings from forecasting (required capacities and numbers).

Forecasting, alongside foresighting, provides vital input to the sector, feeding into recruitment and development targets for employers, and consideration of economic class sizes and recruitment targets for educators. However, it is beyond the scope of the foresighting study to carry out independent forecasting, and as such readers should refer to referenced studies for detail on forecasting.

1.4 Introducing the Visualisation Tool

The Workforce Foresighting Hub's Visualisation Tool is a powerful, innovative system, which will enable the reader to explore and analyse foresighting data to determine the capabilities required for future roles. Links throughout this report make it easy to identify existing standards which meet the needs of these future roles and pinpoint where new standards are necessary to develop a skilled workforce equipped to adopt new technologies.

The data is generated by the foresighting cycles, integrating the expertise of technologists or domain specialists, employers and educators. The data informs the development of future curriculums and course content as determined by the action plan. Using AI tools validated by human oversight, and by linking to external data sources, the tool identifies differences at the level of occupation/role as well as detailed changes required to help update/refresh knowledge, skills and behaviours thus delivering insights for learners, providers, creators and assurers of skills.

Detailed instructions on how to use the Visualisation Tool can be found in the appendix.(Appendices)

Data Capture Overview[2]

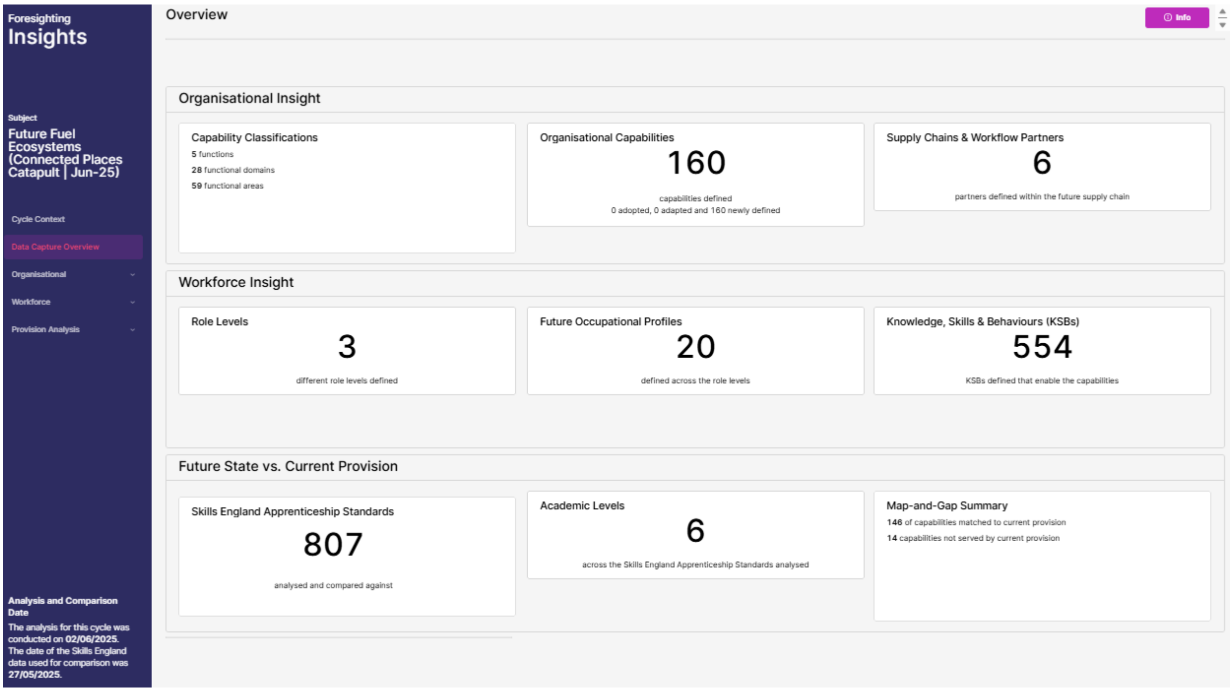

Figure 2: Data capture overview

[2] Data capture overview https://hvmcatapultforesighting.retool.com/embedded/public/e869283b-4b8a-437c-973e-64ab292e5b87?_environment=production&token=8953f841a9b37a93b0f3ebc5c4f68c4b

2. Aligning the Challenge and Solutions with national priorities

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Section	Title
2.1	Positioning and context of challenges
2.2	Potential and prioritised Solutions to Challenge
2.3	Workforce foresighting for chosen prioritised technology solution
2.4	Current and predicted scale of technology deployment in UK
2.5	Key Stakeholders

2.1 Positioning and context of national challenge

The UK Government has established an unambiguous commitment to achieve Net Zero emissions by 2050[3], positioning aviation as a priority sector for comprehensive decarbonisation. The Jet Zero Strategy[4] articulates a definitive pathway for reducing aviation emissions through the strategic adoption of Sustainable Aviation Fuel (SAF), hydrogen, and electric propulsion technologies. These technological solutions represent the cornerstone of both near-term carbon reduction initiatives and long-term climate objectives.

Innovate UK's Strategic Delivery Plan 2022–2025[5] amplifies this strategic focus by identifying Net Zero and Digital & Technologies as two of its three fundamental impact domains. The workforce foresighting cycle directly aligns with these national priorities by examining the human capital implications of deploying cyber-physical security systems for multi-fuel infrastructure across UK airports.

This alignment reflects a sophisticated understanding that technological transformation cannot succeed without corresponding workforce development. The integration of digital and physical systems in aviation infrastructure demands new competency frameworks that bridge traditional operational expertise with emerging cybersecurity and alternative fuel management capabilities.

2.2 Sector Context and Strategic Importance

The UK aviation sector represents a substantial economic driver, contributing over £22 billion annually[6] to the national economy while supporting more than 350,000 jobs[7]. This economic significance extends beyond immediate employment impacts to encompass broader industrial ecosystem effects, including aerospace manufacturing, logistics, and tourism dependencies. Global positioning establishes the UK as home to leading aerospace manufacturers and premier airport operators, with strategic ambitions to become the world's preeminent hub for sustainable aviation innovation. This positioning creates both opportunities and obligations – the opportunity to lead global markets in clean aviation technologies, coupled with the obligation to demonstrate that sustainable transformation is achievable without compromising operational excellence or economic competitiveness.

However, workforce challenges present significant obstacles to realising these ambitions. Industry surveys reveal that 75% of UK manufacturers struggle to recruit talent capable of supporting emerging technologies[8], a challenge that mirrors and intensifies within aviation. The transition to alternative fuels demands entirely new competency sets spanning hydrogen safety protocols, sophisticated digital systems management, and complex infrastructure integration capabilities.

This workforce gap reflects a fundamental misalignment between existing educational and training systems and the rapidly evolving technological landscape. Traditional aviation training programs, developed for conventional fuel systems and analogue operational environments, prove inadequate for the cyber-physical systems that will define future airport operations. Technology Changes and Future Outlook.

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3 Source: Gov UK.
4 Source: Gov UK.
5 Source: UKRI.
6 Source: UK Parliament.
7 Source: Innovate UK.
8 Source: Barclays.

The aviation sector confronts unprecedented technological transformation driven by multiple converging innovations, each introducing distinct operational requirements and workforce implications:

- Hydrogen fuel systems demand mastery of cryogenic storage technologies, sophisticated leak detection protocols, and specialised safety procedures that differ fundamentally from conventional aviation fuel handling. The unique properties of hydrogen – including its low storage temperature, high energy density, and enhanced flammability – require entirely new operational paradigms and safety cultures.

- Sustainable Aviation Fuel (SAF) introduces complex requirements for fuel blending expertise, sophisticated distribution network management, and enhanced regulatory compliance capabilities. Unlike conventional aviation fuel, SAF systems require understanding of biofuel chemistry, supply chain traceability, and quality assurance protocols that span multiple industrial sectors.

- Electric aircraft infrastructure involves high-capacity charging systems, smart grid integration technologies, and energy management capabilities that bridge aviation and electrical engineering domains. The power requirements for electric aircraft charging approach those of small industrial facilities, demanding expertise in high-voltage systems and grid stability management.

Cyber-physical security systems emerge as essential infrastructure protection mechanisms, defending multi-fuel facilities against digital threats while ensuring operational resilience across increasingly complex technological environments. These systems require understanding of both operational technology (OT) and information technology (IT) domains, with particular emphasis on the vulnerabilities that emerge at their intersection.

The convergence of these technological changes will fundamentally reshape airport operations, supply chain management, and regulatory frameworks. The foresighting cycle anticipates widespread deployment of these integrated systems by 2030, with early pilot programs already demonstrating feasibility at major UK airports.

This compressed timeline creates unprecedented urgency for workforce development initiatives. Unlike previous technological transitions that evolved over decades, the climate imperative demands rapid deployment of alternative fuel systems within the current decade. This acceleration intensifies the workforce development challenge while simultaneously limiting the time available for traditional training system adaptation.

The contrast between technological readiness and workforce preparedness represents the central challenge addressed by this foresighting cycle. While the engineering solutions for sustainable aviation exist and demonstrate increasing commercial viability, the human capital required to deploy, operate, and maintain these systems remains critically underdeveloped. Success in meeting national Net Zero targets depend not only on technological innovation but on coordinated workforce transformation that enables safe, secure, and efficient operation of next-generation aviation infrastructure.

2.3 Potential and prioritised technology solutions to the challenge

Technology solutions underwent rigorous evaluation through a structured foresighting process that combined expert workshops, comprehensive stakeholder interviews, and systematic analysis of sector transformation trends. This multi-stakeholder approach ensured that technical feasibility assessments were balanced against practical implementation requirements and workforce development considerations.

The evaluation framework incorporated five assessment dimensions: alignment with Net Zero objectives and aviation decarbonisation mandates, relevance to airport infrastructure and operational transformation requirements, workforce implications and training system feasibility, cybersecurity and safety compliance requirements, and scalability considerations with realistic deployment timelines.

Initial technology options emerged from the CONSIDER Survey 2025, with subsequent refinement during the Carry Out phase reflecting the evolved focus on cyber-physical security for multi-fuel infrastructure. This iterative approach allowed the foresighting process to respond to emerging stakeholder insights while maintaining strategic alignment with sector transformation objectives.

2.4 Technology Options Considered

Technology Option	Description	Relevance to Challenge
Cyber-Physical Security Systems	Integrated IT/OT systems to secure multi-fuel infrastructure	Chosen technology. Addresses safety, cybersecurity, and operational resilience
Digital Twins	Virtual replicas of fuelling systems for simulation and monitoring	Useful for training and scenario testing, but not prioritised in this cycle

Table 3: Technology Options Considered

Chosen Technology and Justification

Cyber-Physical Security Systems for Multi-Fuel Infrastructure emerged as the prioritised technology solution due to its comprehensive capability to secure hydrogen and SAF fuelling systems against cyber threats, enable safe integration of digital and operational technologies, support compliance with evolving regulatory frameworks, and provide a robust foundation for workforce development across both physical and digital competency domains.

The technology's threat mitigation capabilities enable robust protection of hydrogen and SAF fuelling systems against sophisticated cyber threats that specifically target the vulnerabilities emerging at the intersection of digital control systems and physical infrastructure. Unlike conventional cybersecurity solutions focused solely on information technology, cyber-physical security systems understand and protect the operational technology (OT) environments that directly control physical processes.

Integration capabilities facilitate safe convergence of digital and operational technologies, enabling airports to modernise infrastructure systems while maintaining operational safety standards. This integration proves particularly critical for hydrogen systems, where digital monitoring and control systems must interface with cryogenic storage and high-pressure distribution networks.

Regulatory compliance support ensures alignment with evolving frameworks, including the Critical Entities Resilience Directive (CER), which explicitly addresses cyber-physical vulnerabilities in critical infrastructure. This compliance dimension becomes increasingly essential as regulatory frameworks evolve to address the unique risks associated with alternative fuel systems.

Workforce development foundations provide comprehensive training platforms spanning both physical safety protocols and digital risk management competencies. This dual-domain approach ensures that operational staff develop integrated competencies rather than siloed expertise, reflecting the interconnected nature of modern airport infrastructure.

The chosen technology directly addresses the fundamental challenge of enabling future fuel ecosystems at airports while systematically mitigating risks associated with infrastructure vulnerabilities and workforce readiness gaps.

Current State Analysis and Supply Chain Impact

Current infrastructure across most UK airports reflects legacy fuelling systems characterised by limited digital integration and conventional fuel handling protocols. Existing systems were designed for single fuel types with established safety and operational procedures, creating significant adaptation challenges for multi-fuel environments.

Emerging infrastructure development shows hydrogen and SAF systems in early pilot stages, with minimal operational staff trained in specialised handling or security protocols required for these advanced fuel systems. This pilot phase provides valuable learning opportunities while highlighting the scale of workforce transformation required for sector-wide deployment.

Supply chain transformation demands coordinated capability development across multiple stakeholder categories:

- **Fuel developers and suppliers** must develop comprehensive cybersecurity and regulatory compliance capabilities that extend beyond traditional fuel chemistry expertise to encompass digital threat assessment and infrastructure protection protocols.
- **Airport operators** face intensive upskilling requirements for ground handling and emergency response teams, necessitating the development of competencies spanning fuel safety, cyber-physical system operation, and incident response procedures specific to alternative fuel environments.
- **Infrastructure providers** confront complex integration challenges requiring seamless coordination between IT/OT systems and safety protocols, demanding expertise that bridges traditional engineering domains with cybersecurity and regulatory compliance requirements.
- **Regulatory bodies** must develop sophisticated oversight capabilities for cyber-physical resilience and safety standards, requiring new expertise in alternative fuel systems, cybersecurity assessment, and operational technology vulnerabilities.

Timing Considerations

The implementation pathway reflects a carefully structured progression that balances deployment urgency with workforce development requirements and operational safety considerations.

Short-Term (2025–2027) focuses on pilot deployments at selected airports, establishing proof-of-concept operations while developing initial workforce training capabilities and continuing professional development frameworks. This phase emphasises learning and capability building rather than scale deployment.

Mid-Term (2027–2030) encompasses wider rollout of cyber-physical systems across the UK airport network, accompanied by formalisation of new occupational standards and systematic scaling of training provision through established educational partnerships.

Long-Term (2030+) anticipates advanced integration with smart grid infrastructure and electric aircraft charging systems, incorporating sophisticated simulation and monitoring capabilities that reflect mature cyber-physical security ecosystems.

2.5 Workforce Foresighting for Chosen Prioritised Technology Solutions

Cyber-Physical Security Systems for Multi-Fuel Infrastructure were selected as the focus of the foresighting cycle due to its critical role in enabling the safe, secure, and scalable deployment of hydrogen, electric, and Sustainable Aviation Fuel (SAF) systems at UK airports. It addresses both physical safety and digital resilience, ensuring compliance with emerging regulations such as the Critical Entities Resilience Directive (CER) and the UK Aviation Cybersecurity Strategy.

Cyber-physical systems integrate operational technology (OT) and information technology (IT), allowing for real-time monitoring, automated control, and threat detection across fuel infrastructure. Their deployment is essential to mitigate risks associated with volatile fuels, complex logistics, and digital vulnerabilities. The cycle was titled: **Enabling Future Fuel Ecosystems at Airports.**

2.6 Current and predicted scale of technology deployment in UK

Current State of Deployment

The UK aviation sector occupies an early transitional phase in its migration toward alternative fuel ecosystems, characterised by promising pilot initiatives alongside significant infrastructure and capability gaps. While **Sustainable Aviation Fuel (SAF)** demonstrates operational viability through trials at several airports, **hydrogen and electric aircraft infrastructure** remain predominantly confined to pilot programs and feasibility assessments. This developmental disparity reflects both the varying technical maturity of different fuel technologies and the complex integration challenges associated with multi-fuel airport operations.

Most UK airports continue operating infrastructure designed for conventional fuel systems, lacking the integrated technological capabilities required to safely store, distribute, and manage multiple fuel types simultaneously. This infrastructure limitation extends beyond simple equipment upgrades to encompass fundamental operational paradigm shifts requiring new safety protocols, monitoring systems, and workforce competencies.

Hydrogen infrastructure development remains limited to demonstration projects and feasibility studies, with storage and refuelling systems not yet standardised or widely deployed. The technical challenges associated with cryogenic storage, leak detection, and safety protocols have prevented progression beyond pilot phases, despite growing interest from industry and government.

SAF distribution shows more advanced development, with blending and distribution operations underway at select airports. However, supply chain scale-up remains essential to meet anticipated future demand, requiring coordination between fuel producers, distributors, and airport operators to ensure adequate provision and quality assurance.

Electric aircraft charging infrastructure remains minimal, constrained by grid capacity limitations and underdeveloped charging system technologies. The power requirements for electric aircraft exceed conventional airport electrical infrastructure capabilities, necessitating substantial grid upgrades and smart energy management systems.

Cyber-physical security systems represent the most significant gap, as existing airport systems were not designed to manage integrated IT/OT environments. Current cybersecurity capabilities remain fragmented and inadequately tailored to the specific vulnerabilities and operational requirements of multi-fuel operations.

These technological limitations are compounded by workforce capabilities that do not yet encompass the safety, compliance, and operational complexity management required for alternative fuel systems. This workforce-technology gap represents a critical constraint on deployment acceleration.

Predicted Scale of Deployment (2025–2030)

Deployment acceleration is anticipated to intensify significantly over the next five years, driven by converging forces including regulatory pressure, substantial industry investment, and national climate commitments. This acceleration will create unprecedented demands for coordinated infrastructure development and workforce transformation.

Technology Area	Deployment Forecast (UK)	Workforce Implications
Hydrogen Fuel Infrastructure	Pilots at major airports by 2027; wider rollout by 2030	High demand for hydrogen safety technicians, infrastructure engineers
SAF Distribution Systems	Scaling from 2025; expected to be standard by 2030	Need for compliance officers, blending specialists
Cyber-Physical Security Systems	Regulatory-driven adoption by 2028; full integration by 2030	Cyber-physical engineers, OT cybersecurity specialists
Electric Aircraft Charging Systems	Early-stage development; expected growth post-2030	Electrical infrastructure specialists, smart grid planners

Table 4: Predicted Scale of Deployment (2025–2030)

This deployment timeline reflects both technological readiness and regulatory framework development, with cyber-physical security systems experiencing remarkably rapid adoption driven by compliance requirements rather than purely commercial considerations.

Hydrogen infrastructure deployment follows a carefully managed progression, recognising the safety complexities and specialised expertise requirements associated with cryogenic fuel handling. The timeline allows for pilot program learning integration while building the workforce capabilities essential for safe operations.

SAF systems benefit from greater technical maturity and operational experience, enabling more aggressive deployment schedules while requiring substantial workforce development in regulatory compliance and quality assurance capabilities.

Cyber-physical security adoption will be accelerated by regulatory mandates, particularly the Critical Entities Resilience Directive, creating compressed timelines for both technology deployment and workforce development.

Supply Chain Impact

Successful deployment demands orchestrated action across six critical supply chain partners, each requiring substantial organisational capability development and new occupational role creation:

- Fuel developers and suppliers must dramatically scale hydrogen and SAF production capabilities while developing sophisticated storage and logistics systems. This expansion requires new expertise in alternative fuel chemistry, cryogenic handling, and supply chain security protocols that extend far beyond conventional fuel industry competencies.
- Airport operators face comprehensive infrastructure retrofitting challenges alongside complex operational and safety management transformation. These operators must develop integrated capabilities spanning alternative fuel handling, cyber-physical system management, and emergency response protocols specific to multi-fuel environments.
- Regulatory bodies must define and enforce evolving safety, cybersecurity, and environmental standards for technologies and operational paradigms that lack extensive precedent. This regulatory development requires new expertise in alternative fuel systems, cyber-physical vulnerabilities, and operational technology security assessment.
- Original technology manufacturers encounter requirements to develop aircraft and fuelling systems compatible with diverse fuel types while ensuring seamless integration with airport infrastructure. This development demands unprecedented collaboration between aerospace engineering, fuel system design, and cybersecurity domains.
- Fuel infrastructure providers must build and maintain storage and distribution systems that safely handle multiple fuel types while integrating sophisticated monitoring and security capabilities. These providers require new competencies bridging traditional fuel handling expertise with cyber-physical system management.
- Electrical infrastructure specialists face demands to upgrade grid capacity and install high-capacity charging systems that support electric aircraft operations without compromising broader grid stability. This specialisation requires integration of aerospace, electrical engineering, and smart grid management expertise.

Each partner group must simultaneously develop new organisational capabilities and occupational roles while maintaining current operational excellence, creating unprecedented demands for coordinated workforce development initiatives. The success of technology deployment depends not only on the development of individual partner capabilities but on effective coordination mechanisms that ensure seamless integration across the entire supply chain ecosystem.

The compressed deployment timeline intensifies these coordination challenges while highlighting the critical importance of the workforce foresighting approach in anticipating and preparing for these complex capability requirements before they become operational constraints.

3. Findings and Results

3. Findings and Results

Section	Title
3.1	Methodology and Findings
3.2	Step One – How will the Supply Chain change - Organisational Changes Insight
3.3	Step Two – How will the Workforce change - Occupational Change Insight
3.4	Step Three – How the current Education provision meets the future need Highlighted Changes for Future provision

3.1 Methodology and Findings

Summary information is provided with a narrative based on the underlying data which is also provided using bespoke visualisations to enable greater insight and access to detail. The report is aligned to the needs of those responsible for workforce planning – employers, educators, and skills providers.

Step One: How will the Supply chain change - Organisational Changes

Exploration of organisational changes provides insights into how organisations will need to adapt their current capabilities to implement the solutions that respond to the challenge addressed by the foresighting project.

Typically, organisational changes will also require the adoption of new capabilities and a change in the distribution of these capabilities across supply chain partners. The change in capabilities within an organisation as well as their supply chain partners will determine the changes knowledge and skill changes required by the role groups within the workforce of each Supply Chain partner.

Step Two: How will the Workforce change - Occupational Changes

A set of 'Future Occupational Profiles' (FOPs) is produced by the foresight process that demonstrates how current occupations may need to change in the future. FOPs are generated using a combination of attributes from the underlying capability classification and from data collected in the workshops. The FOP generation algorithm works to group capabilities into logical sets reflecting role levels, function, proficiency and capability similarity. As part of the foresight process the generated FOPs are reviewed, revised and distilled by the Employer group. The agreed set of FOPs are then compared with selected current education provision; the default reference is the set of Institute for Apprenticeships and Technical Education (IfATE) apprenticeship standards; to assess which current training and education provision could be used in the future. Two bespoke metrics - match and surplus - are used to evaluate the alignment of current provision with the set of FOPs proposed. Summaries are presented of the key findings related to each Supply Chain partner.

Findings are aimed at both Employers, and Education and Training Providers, and identify matches and gaps in future training needs compared with current provision to guide further detailed investigation.

Step Three: How the current Education provision meets the future need - Highlighted Changes to Future Provision

The report identifies suggested changes to education and training provision – principally apprenticeship standards that will deliver the knowledge, skills and behaviours required by future occupations. In some cases, this will include the development of short courses and continued professional development (CPD) to upskill the current workforce to meet future needs. Additionally, foresighting outputs can be used to develop programmes, qualifications, and apprenticeship standards for new entrants to the workforce joining via apprenticeship, taught qualification, or other training programme.

The insight and data in this part of the report are primarily aimed at educators training providers, apprenticeship standards bodies and awarding organisations. Combined with insight arising from the Supply Chain capability changes, the provision insight offers an effective way for employers to identify training opportunities that align to their future needs.

3.2 Step One: How will the Supply Chain change

Organisation changes insight

Organisation functions

The Workforce Foresighting process uses an information architecture built on five functional areas which are common to any business:

Design	The function of an organisation that focuses on activities relating to product, service or solution design.
Implement	The function of an organisation that focuses on activities relating to producing / making / providing its products or services.
Logistics	The function of an organisation that focuses on activities relating to procurement, delivery, materials, or services necessary for operations – service / manufacturing, etc.
Support	The function of an organisation that focuses on activities relating to users, in-service support, repair / maintenance, recycling, end of life disposal.
Enterprise	Core functions of an organisation - e.g., strategic planning, leadership and management, human resources, digital backbone and data systems, integration of relevant statutory / regulatory requirements and compliance.

Table 5: Organisation functions

The functional structure is developed to levels of detail that enable the foresight process to reference external data sets including ONET (US) Occupational Information Network [[9]], ESCO – European Skills, Competences, Qualifications and Occupations[[10]], IfATE (UK) Institute for Apprenticeships and Technical Education[[11]] .

The five root functions comprise around 40 domains which are broken down to around 140 functional areas. The architecture is used to position ~ 25,000 capability statements which are the building blocks used in the workforce foresight process. Each capability statement has several attributes - some are static and reflect the position of the capability statement in the architecture, whilst others are dynamic and are assigned values through a cycle and set of workshops.

The data architecture is implemented in a bespoke ‘data-cube’ which underpins the foresight process, workshops, and enables extensive use of LLM and AI tools. Additionally, a key feature of the data-cube is that the data from each foresight topic cycle is added into the data set and can then be used, where relevant, in future cycles. This ensures that the capabilities of the system are dynamic and up to date.

[9] ONET - Occupational Information Network - https://www.onetcenter.org/
[10] ESCO - European Skills, Competences, Qualifications and Occupations - https://esco.ec.europa.eu/en
[11] IfATE – Institute for Apprenticeships and Technical Education - https://www.instituteforapprenticeships.org/

Identifying the Future Supply Chain Capabilities

The following charts and graphs summarise the changes in the set of capabilities that will be required by the supply chain (Supply Chain involved in production) in the future. The pie-charts reflect the distribution of capabilities across the five functions of the capability classification. The future state data is captured in three technology focused workshops. The current state data is derived from information collected on apprenticeship standards used across current supply chain partners. sector. This latter information is not as detailed as that produced by the workshops but is indicative and used to provide a point of comparison. These initial pie charts summarise the changes that will be required by the whole supply chain, across the five functions.

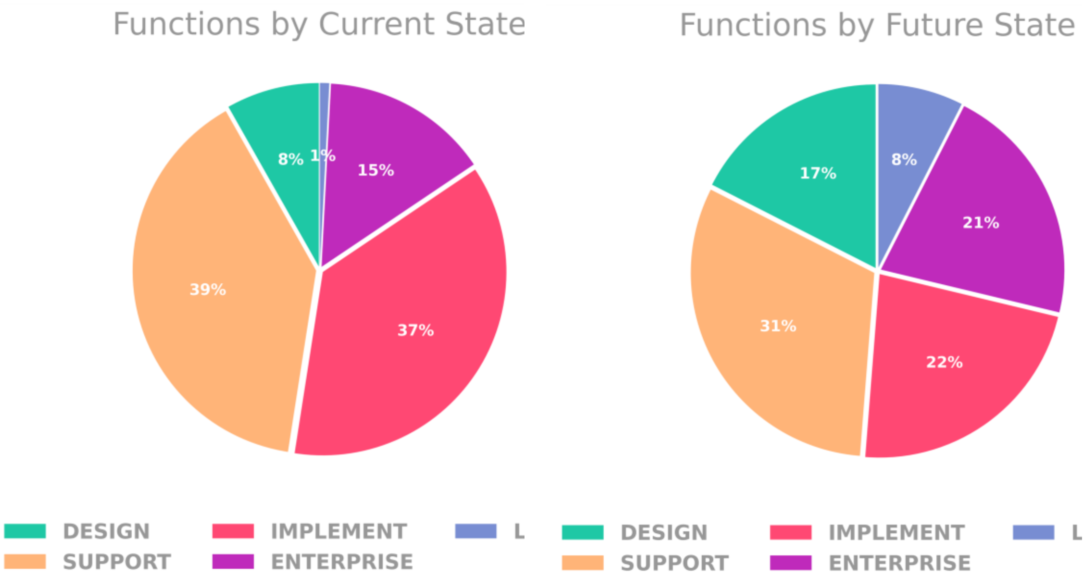


Table 6: Current and Future – Whole Supply Chain - Capability Function Distribution %

Whilst the information on current and future Supply Chain capabilities is useful to indicate relative changes, factors such as volume of activity will also determine which functions may have greater future significance.

The graphs below show the distribution of capabilities assigned at domain level within the five main functions for this cycle. These graphs provide insight into the relative importance of each domain for the screen sector in the future.

Design Domains

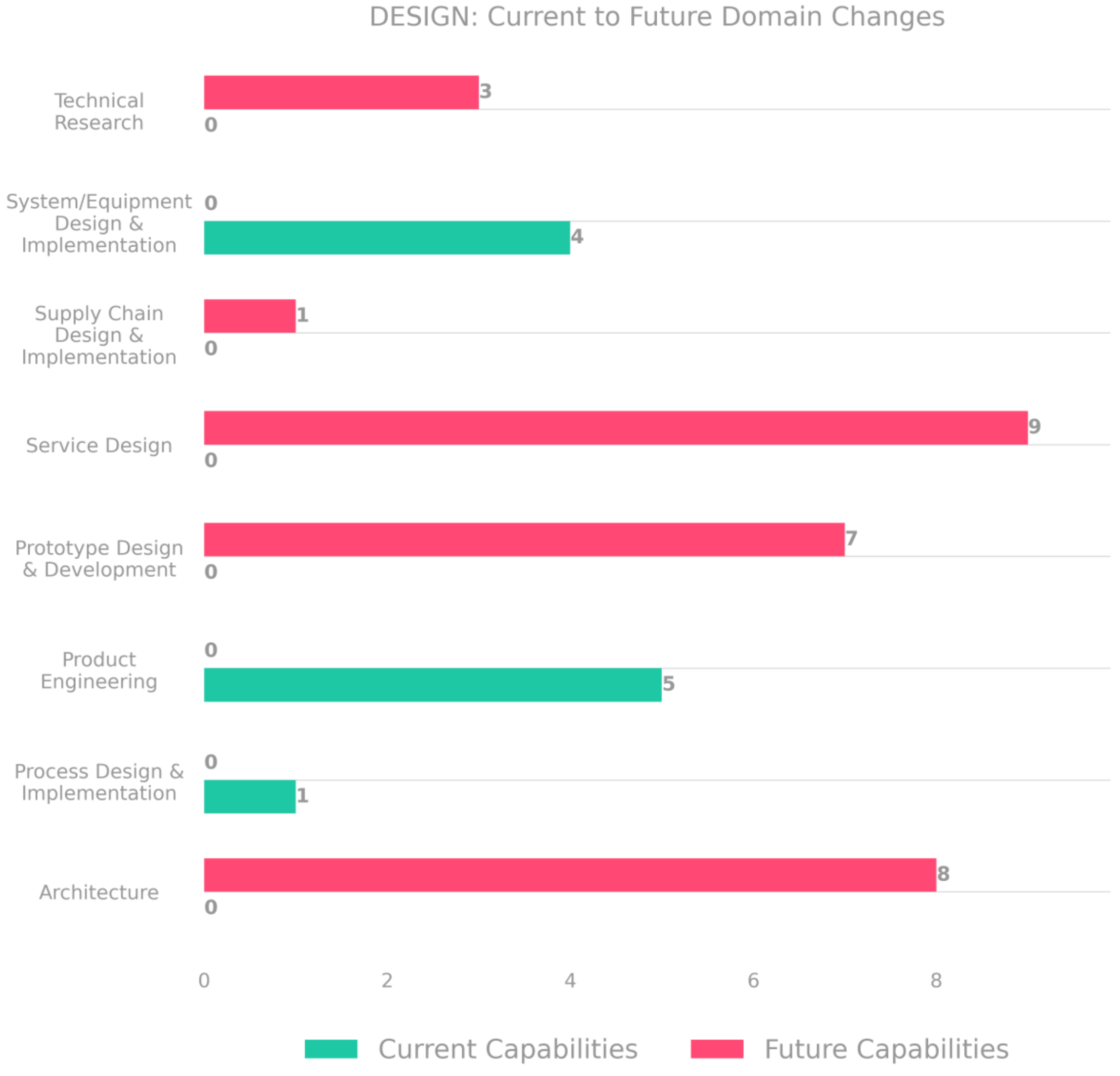


Figure 3: Figure 5: Design Future Domain Spread of Capabilities

The design function has the **highest number organisational capabilities with 46 out of a total of 131 capabilities for this cycle**, reflecting the cycle focus of AI in image asset creation. At domain-level, the highest number of capabilities exist within the process design and implementation domain. These include capabilities to model processes or develop processes. The second highest is in prototype design and development with a high requirement for the design of systems and applications, rather than physical prototypes.

The current / future comparison for Design reflects the foresighted transition to an increase in new products, engineering, and evaluation ahead of the development and implementation phase.

Enterprise Domains:

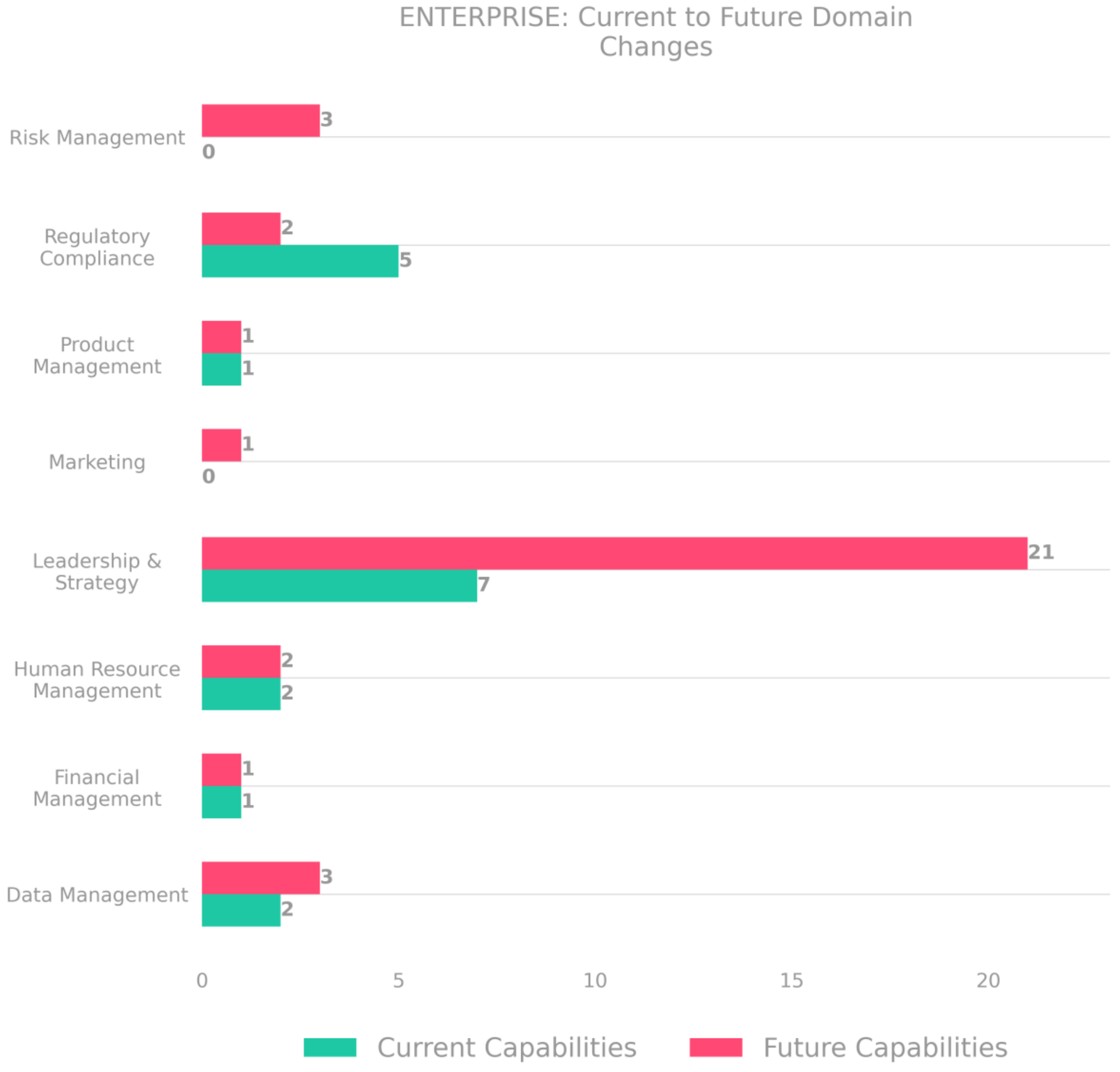


Figure 4: Enterprise Future Domain Spread of Capabilities

Second highest ranking is the enterprise function with 31 capabilities out of 131. Most capabilities sit in the Data Management domain; focusing on areas such as performing data analysis; data storage design and evaluating data quality. Capabilities in the domain of leadership and strategy include identifying new business partnerships for this emerging technology; identifying business threats and opportunities; and evaluating environment impact. Regulatory compliance capabilities also feature in this function including coordinating compliance activities and monitoring compliance and regulation changes.

The current / future comparisons in the Enterprise area show the increased need associated with a maturing and competitive regulated market and the need to increase human resources.

Implementation Domains

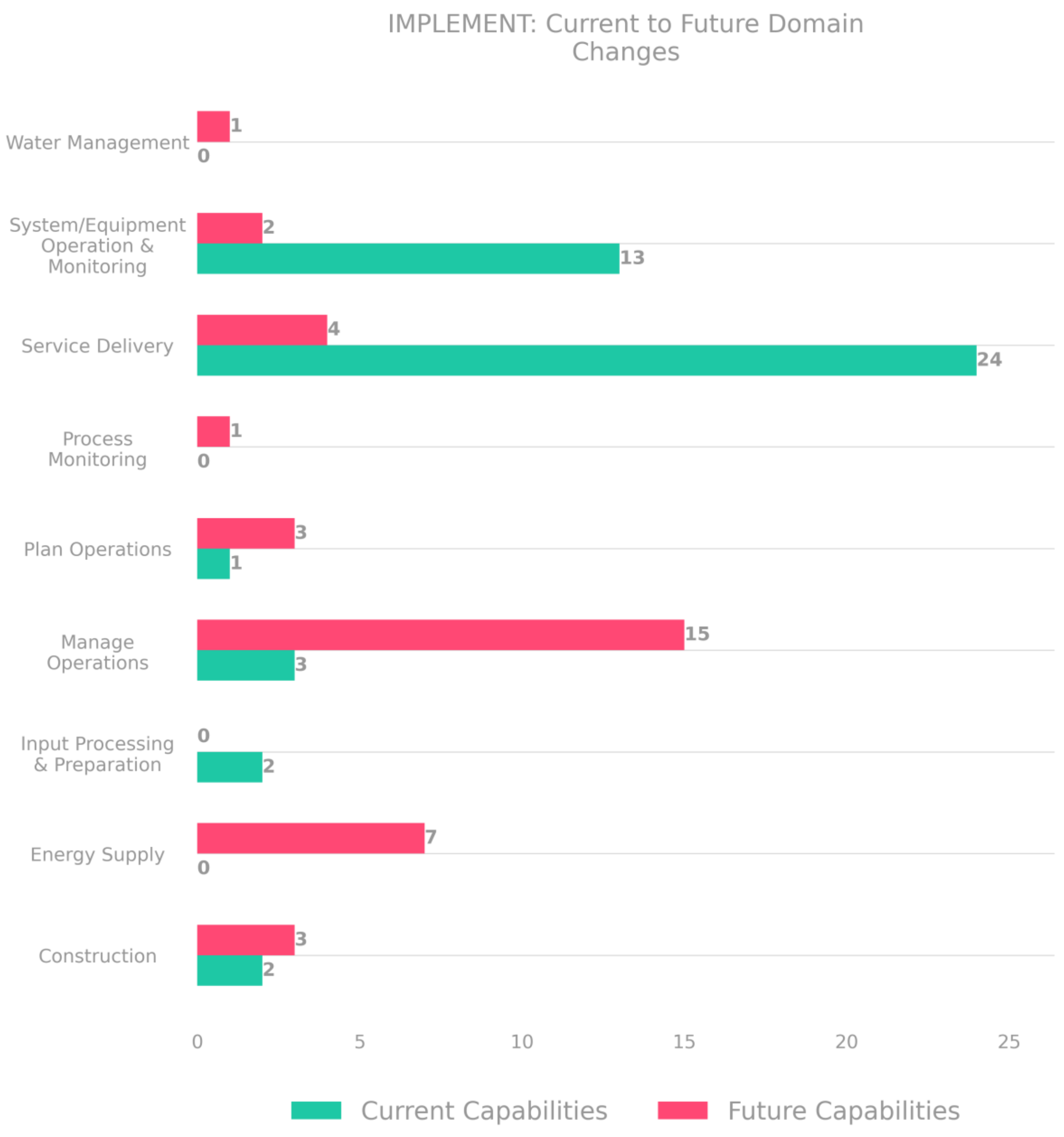


Figure 5: Implementation Future Domains Spread of Capabilities

Of the 131 cycle capabilities for the cycle, 28 sit in the ‘implement’ function with most operating in the service delivery domain in areas such as creating and processing digital media; analysing and verification of information; planning and scheduling of services; and communicating and translating information. Closely behind are system and equipment monitoring and manage operations.

The current / future comparison of implementation functions reflects the changes associated with greater adoption and product sales volume.

Logistics Domains

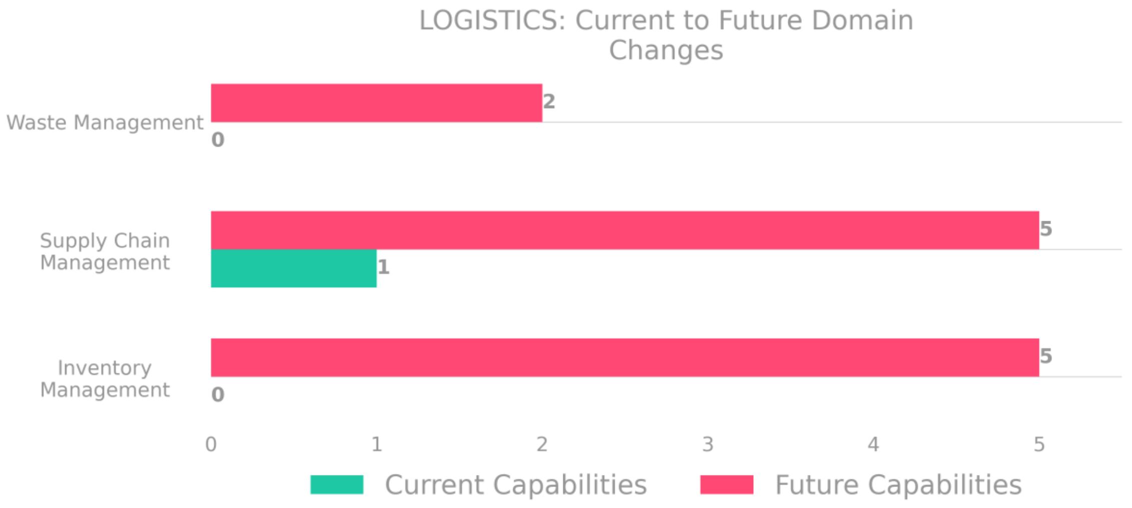


Figure 6: Logistics Future Domains- Future Spread of Capabilities

Only 5 capabilities out of 131 sit in the logistics function, reflecting the cycle focus on AI in image asset creation. Of those five capabilities, they operate in the functional areas of identifying and working with suppliers; monitoring inventories; coordinating logistics; and providing transport services.

The current and future comparison for logistics is as expected for organisations gearing up to work at a higher scale of production.

Support Domains

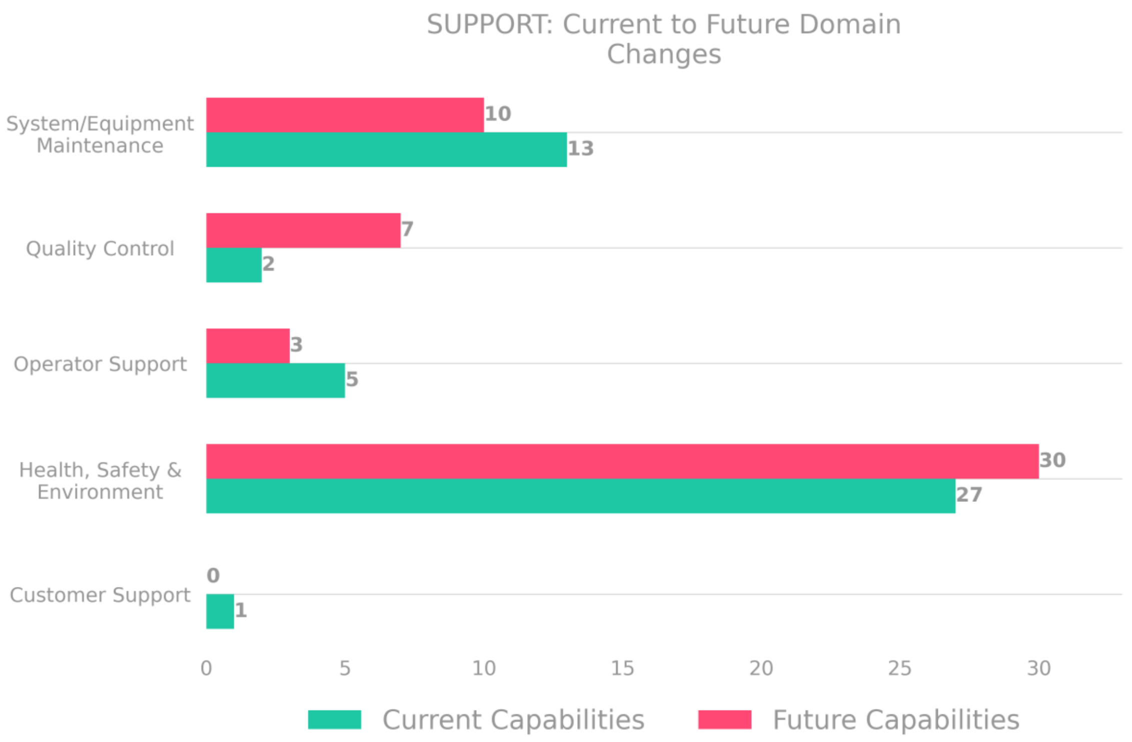


Figure 7: Support Future Domains - Future Spread of Capabilities

The 'support' function has **21 capabilities of the 131 for the cycle**, with the Operator Support domain being the highest. This included capabilities in areas such as designing and configuring support systems and operating support systems

The current and future support comparison reflects the current prominent levels of Health and Safety – the reduction in proportions may be due to omissions during the data gathering and analysis.

Visualisation Instructions

Visualisation Data Link	What is it and what can it be used for?
Organisational Capabilities[12]	The page provides details of the capabilities required by each supply chain partner and the supply chain as whole. The information is presented using the Capability Classification Framework, Design / Implement / Logistics / Support / Enterprise and can be interrogated and then exported to suit specific user requirements and interest. The information provided also identifies capabilities supported by existing provision, and also where there may be gaps that require new development to support to equip the future workforce.

Figure 8: visualisation instructions - organisational capabilities

[12] Organisational capabilities https://hvmcatapultforesighting.retool.com/embedded/public/f56f84e9-8ab8-414f-aa1a-0b42ab5c71df?_environment=production&token=8953f841a9b37a93b0f3ebc5c4f68c4b

3.3 Step Two – How will the Workforce change

Occupational Change Insight

Insight into occupational change uses the understanding of how capabilities will change across business functions in section 3.2 (**Step One: How will the Supply Chain change**) to inform proposals for how occupations and their associated skills set for each supply chain partner may need be revised to reflect change for each role level within that partner.

Supply Chain partner organisation types

The workforce foresighting process recognises that different partners in a Supply Chain will require appropriate capabilities, and these are determined and agreed in the initial workshops. In this cycle, the following Supply Chain partners were identified and then used during participant workshops and data analysis to determine the organisational needs:

Supply chain partners

1. Fuel Developers / Suppliers.
2. Airport Operators.
3. Regulators.
4. Original Technology Manufacturers.
5. Fuel Infrastructure Providers.
6. Electrical Infrastructure Specialists.

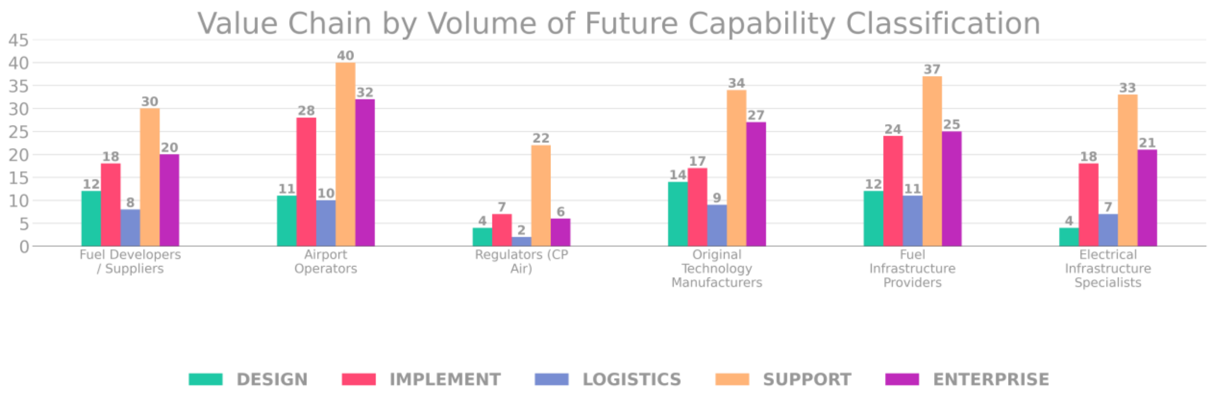


Figure 9: Distribution of Functions across each Supply Chain Partner

The graph illustrates the distribution of capabilities by function across the Supply Chain Partners. These capability sets are used to form the set of Future Occupational Profiles within each role level.

Visualisation Instructions

Detailed instructions can be found in the appendix.(Appendices)

Visualisation Data Link	What is it and what can it be used for?
Supply Chain Capabilities[13]	This page provides an overview of the identified capabilities at a Supply Chain Partner level. By selecting/deselecting each Supply Chain Partner you can review the capabilities identified as required in that area of the Supply Chain. This can be used to generate organisational capability profiles for each area of the Supply Chain to help prioritise and focus the acquisition of new capabilities that will be required in the future. It can also be used to generate combined organisational profiles, where an organisation may be involved in more than one area of the Supply Chain.

Figure 10: Visualisation tool Instructions - supply chain partner capabilities

Role Levels

The foresighting process uses the concept of Role Levels to represent future occupations. Utilising this approach acknowledges that the workforce is not homogeneous, there will be varying levels of proficiency required across a workforce and qualifications and training may be aligned/require different types of vocational or academic qualifications. Additionally, the role level approach seeks to avoid presuming that the future workforce will be operating at a different level to the current state.

Proficiencies

Each of these role levels will require proficiency that reflects their role and the needs of each Supply Chain Partner. The foresight process uses a three-point scale to capture and differentiate the proficiencies required. This information is used both in the generation of the Future Occupational Profiles, and to assist the definition of training needs identified. Within the workforce foresight process proficiency is defined as:

> **Awareness (A)** - Has a foundational knowledge of tools, technology, techniques relevant to sector, industry, or organisation. Sufficient comprehension to know where to seek further information/details as necessary for a particular issue.
>
> **Practitioner (P)** - Has the ability to apply and use independently a tool, system, or process. Understands the implications, consequences, and impact for their role/function. A Practitioner knows what key actions are required and in what context.
>
> **Expert (E)** - Has detailed knowledge of process, system, tool, or technology. Can support others and identify improvements required for a process, system, or tool. An Expert can implement improvements personally or direct and guide others.

During the workshops participants applied their insight to assign proficiency for each role group to each capability. Individual responses were aggregated by the system to arrive at a consensus.

[13] Supply chain partner capabilities https://hvmcatapultforesighting.retool.com/embedded/public/3573002a-ab48-4fad-9765-bee00876a42e?_environment=production&token=8953f841a9b37a93b0f3ebc5c4f68c4b

A summary of the distribution of required proficiency for the role levels in this cycle is:

Proficiency	Junior Level	Mid-Level	Senior Level
Awareness	11	30	1
Practitioner	28	56	33
Expert	9	118	81

Table 7: Proficiency Profile by Role Levels

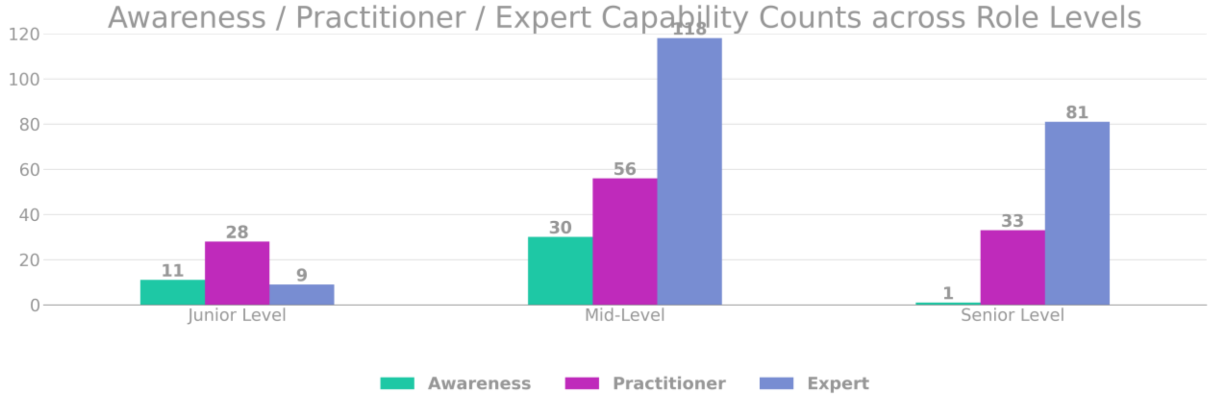


Figure 11: Proficiency details by Role Level

Future Occupational Profiles

FOPs are used to describe and suggest occupations, or roles, that may be required in the future and provide a framework to indicate capabilities and related duties. They can be used to review the impact on current roles and the adaptation that may be required in the future.

> **Educators** can review current apprenticeship standards against the requirements of the FOPs and interpret which need to be changed to fill the gaps between the current and future state.
>
> **Employers** can consider existing apprenticeship standards and make a judgement on adapting an existing apprenticeship standard to upskill their workforce to meet the requirements of a particular FOP.

FOPs and indicative skills need

Combining proficiency with the identified FOPs, the following graphs indicate the priority needs across the supply chain for each Role Group to deliver future capabilities.

Junior Level Role Level FOPs:

In this cycle the Junior Level role level was defined as occupations and roles requiring Level 1 qualifications or apprenticeships.

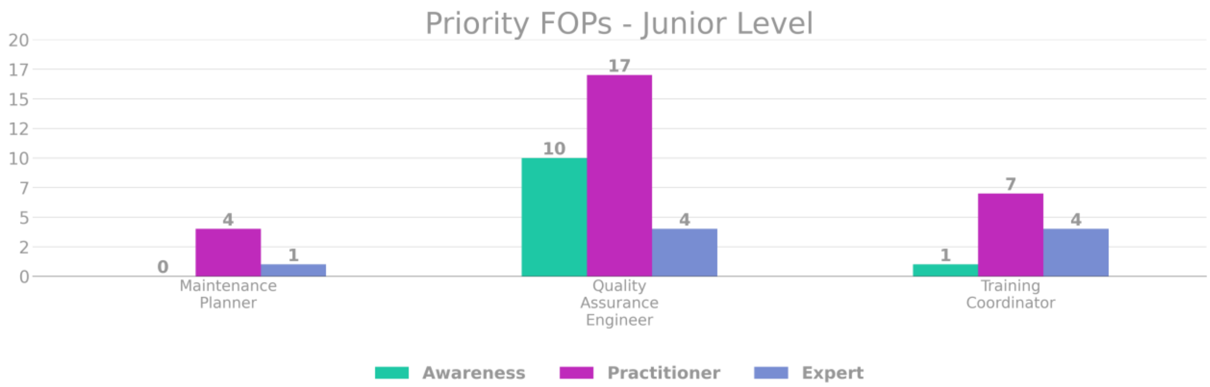


Figure 9: Priority FOPs - Junior Level Role Level

Mid-Level Role Level FOPs:

In this cycle the Mid-Level role level was defined as occupations and roles requiring Level 4 qualifications or apprenticeships.

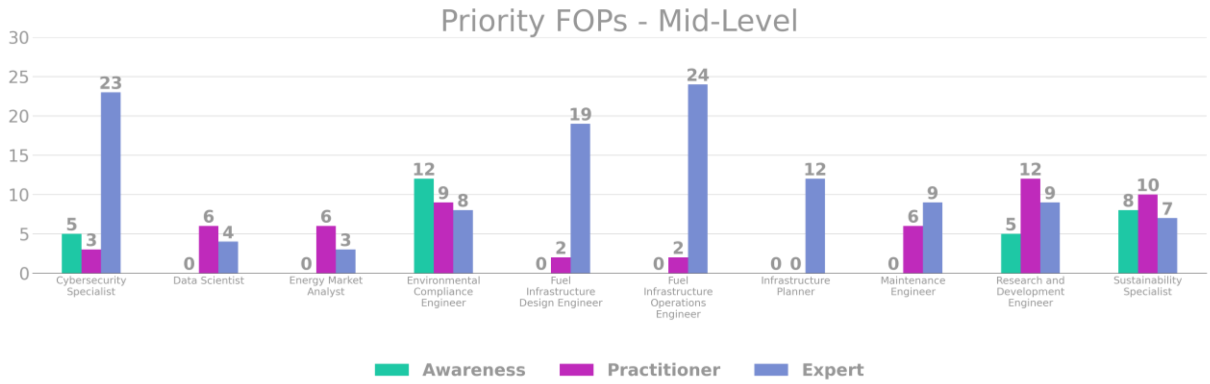


Figure 10: Priority FOPs - Mid-Level Role Level

Senior Level Role Level FOPs:

In this cycle the Senior Level role level was defined as occupations and roles requiring Level 5 qualifications or apprenticeships.

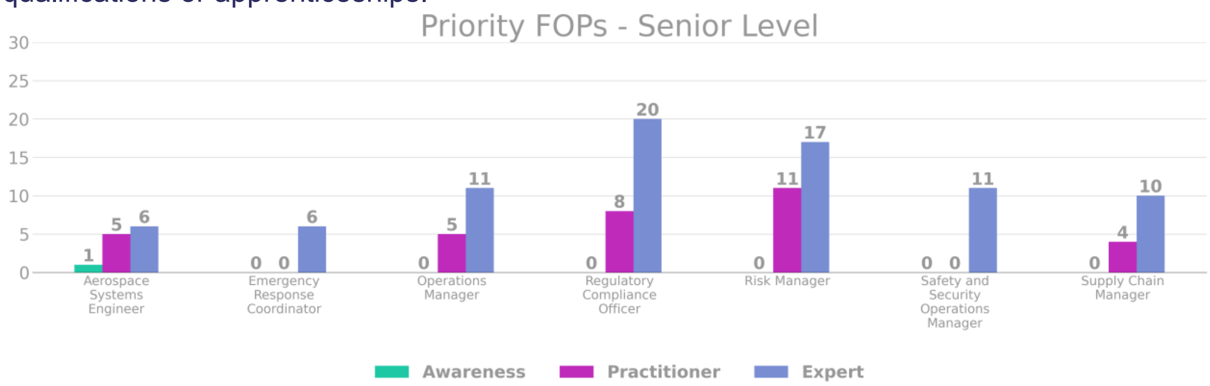


Figure 11: Priority FOPs - Senior Level Role Level

Visualisation Instructions

Detailed instructions can be found in the appendix.(Appendices)

Visualisation Data Link	What is it and what can it be used for?
FOP Matrix	This page provides a detailed breakdown of future occupational profiles that could be required in the future workforce. These were generated using a combination of attributes collected through the workshops and an algorithm. These suggested profiles were then reviewed and ratified by small groups of employers who were able to add/remove capabilities and uprate/downrate proficiency levels required. You can view all the FOPs in a role level by selecting one (or more) of these from the drop down. This will then allow you to select the FOPs aligned to that role level. The populated table allows you review and compares different FOPs within or across role levels. You can view the capabilities in each FOP and the assigned proficiency levels.

3.4 Step Three – How the current Education provision meets the future need

Highlighted Changes for Future Provision

The Workforce Foresighting process has developed two metrics to quantify the alignment between a FOP and a current standard or qualification:

> **Fit** – expressed as a %, it is a measure of the proportion of a FOP that is covered by an existing standard or qualification.
>
> **Surplus** – expressed as a %, it is a measure of the not relevant material in an existing standard that is not required for a FOP.

An ideal existing qualification or standard would have a high fit and low surplus – this implies good coverage of the FOP but with little material that is not relevant to the FOP. Conversely a poor candidate would have a low fit and high surplus. Using these two metrics it is possible to quantitively evaluate, rank, and compare a range of existing provisions against a set of FOPs describing future needs.

Our interpretation is represented by a simple nine-box model to position the suitability of a given current occupational standard to a future occupational profile:

Factor scores

Fit Factor	Fit score	Surplus Factor	Surplus score
0 - 32%	1	81-100%	1
33-65%	2	51-80%	2
66-100%	3	0 - 50%	3

(Multiplying the Fit score by the Surplus score gives a Suitability Grid score of 1-9 as below)

Suitability Grid

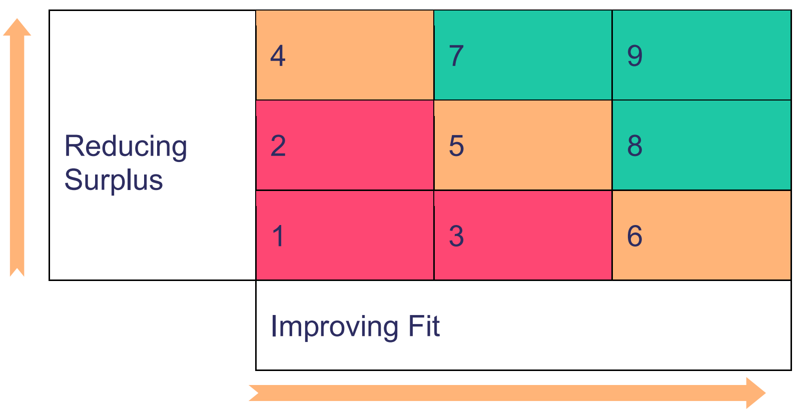


Figure 12: Fit Factor scores and Suitability Grid

Using this score and indicated 'RAG status' the following interpretations can be made:

High Suitability – 7,8,9 – for standards that have good coverage of FOPs.
Represents good candidates from current apprenticeship standards used as the basis of development to meet FOP requirements and inform elements of short course and CPD provision.

Some Suitability– 4,5,6 – for standards that have only partial coverage of FOPs.
These are likely to require extended work to meet FOP requirements, further review of the data may be necessary. They are likely to contain some useful information to inform elements of short course and CPD provision.

Low Suitability – 1,2,3 – for standards that have poor coverage of FOPs.
These are unlikely to be adaptable to meet future needs but may contain some useful information to inform elements of short course and CPD provision, which can be assessed using the data visualisation tools.

FOP findings compared with current standards

Using the approach described above and applying the 'RAG' scores to each FOP indicating the suitability of current apprenticeship standards selected from the IfATE set, the following table begins to identify areas of action and concern for the provision of future skills for each Supply Chain Partner to respond to the challenge.

Supply Chain Partner - Fuel Developers / Suppliers

Role Level	Selected Future Occupational Profiles	Current Suitability Summary
Junior Level	Quality Assurance Engineer	Some
Mid-Level	Cybersecurity Specialist	Low
Mid-Level	Data Scientist	Low
Mid-Level	Energy Market Analyst	Low
Mid-Level	Environmental Compliance Engineer	Low
Mid-Level	Fuel Infrastructure Design Engineer	Low
Mid-Level	Fuel Infrastructure Operations Engineer	Low
Mid-Level	Maintenance Engineer	Low
Mid-Level	Research and Development Engineer	Low
Mid-Level	Sustainability Specialist	Low
Senior Level	Emergency Response Coordinator	Low
Senior Level	Operations Manager	Low
Senior Level	Regulatory Compliance Officer	Low
Senior Level	Risk Manager	Low
Senior Level	Supply Chain Manager	Low

Table 8: Supply Chain Partner - Fuel Developers / Suppliers

Detailed breakdown:

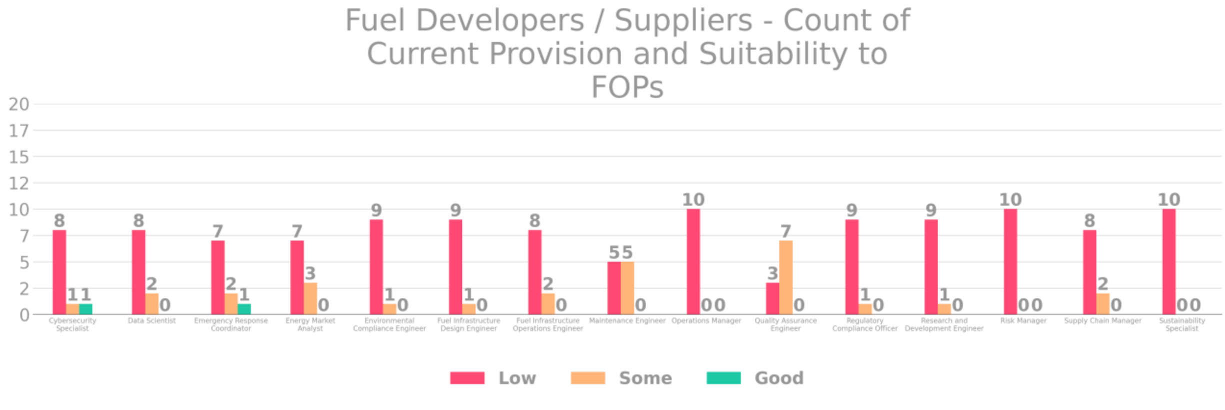


Figure 14: Suitability Summary - Fuel Developers / Suppliers

Supply Chain Partner - Airport Operators

Role Level	Selected Future Occupational Profiles	Current Suitability Summary
Junior Level	Maintenance Planner	Low
Junior Level	Training Coordinator	Low
Mid-Level	Cybersecurity Specialist	Low
Mid-Level	Energy Market Analyst	Low
Mid-Level	Environmental Compliance Engineer	Low
Mid-Level	Fuel Infrastructure Design Engineer	Low
Mid-Level	Fuel Infrastructure Operations Engineer	Low
Mid-Level	Infrastructure Planner	Low
Mid-Level	Maintenance Engineer	Low
Mid-Level	Sustainability Specialist	Low
Senior Level	Emergency Response Coordinator	Low
Senior Level	Operations Manager	Low
Senior Level	Regulatory Compliance Officer	Low
Senior Level	Risk Manager	Low
Senior Level	Safety and Security Operations Manager	Low
Senior Level	Supply Chain Manager	Low

Table 9: Supply Chain Partner - Airport Operators

Detailed breakdown:

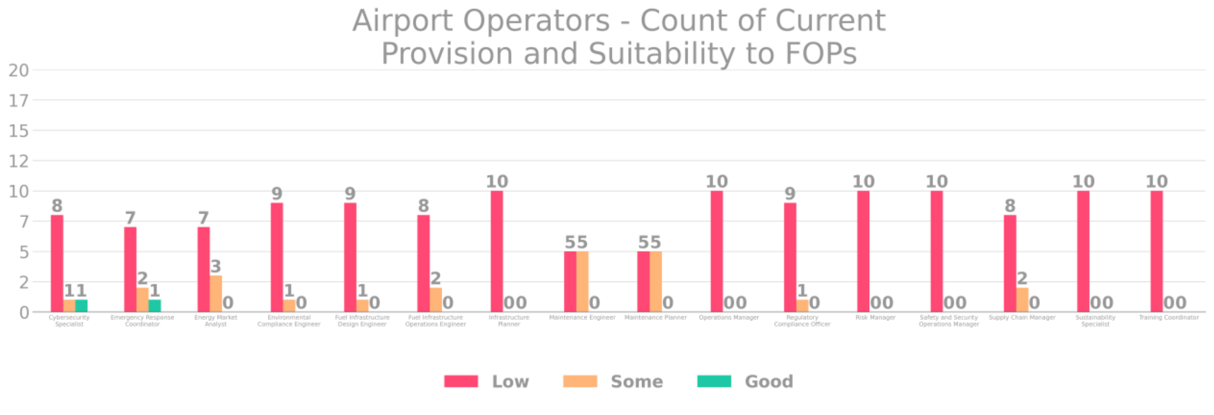


Figure 15: Suitability Summary - Airport Operators

Supply Chain Partner – Regulators

Role Level	Selected Future Occupational Profiles	Current Suitability Summary
Mid-Level	Sustainability Specialist	Low
Senior Level	Regulatory Compliance Officer	Low
Senior Level	Risk Manager	Low
Senior Level	Safety and Security Operations Manager	Low

Table 10: Supply Chain Partner – Regulators

Detailed breakdown:

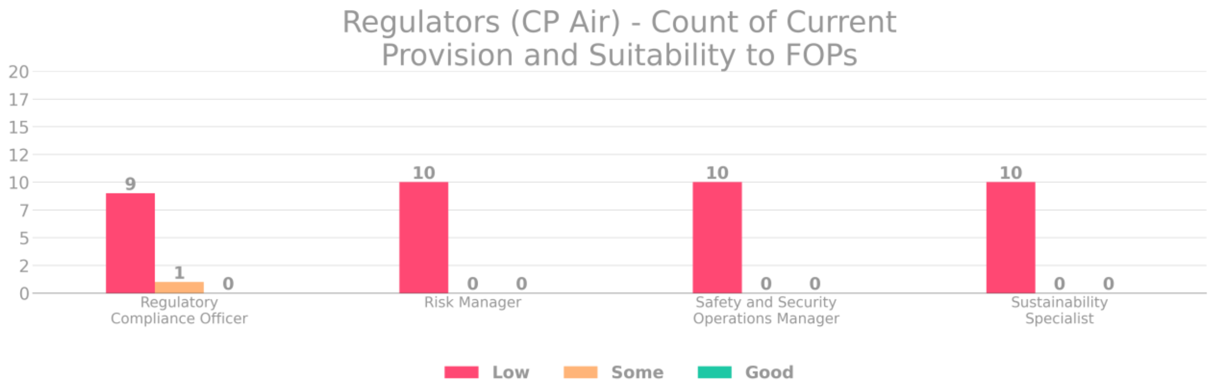


Figure 16: Suitability Summary - Regulators (CP Air)

Supply Chain Partner - Original Technology Manufacturers

Role Level	Selected Future Occupational Profiles	Current Suitability Summary
Junior Level	Quality Assurance Engineer	Some
Mid-Level	Cybersecurity Specialist	Low
Mid-Level	Data Scientist	Low
Mid-Level	Environmental Compliance Engineer	Low
Mid-Level	Maintenance Engineer	Low
Mid-Level	Research and Development Engineer	Low
Mid-Level	Sustainability Specialist	Low
Senior Level	Aerospace Systems Engineer	Some
Senior Level	Supply Chain Manager	Low

Table 11: Supply Chain Partner - Original Technology Manufacturers

Detailed breakdown:

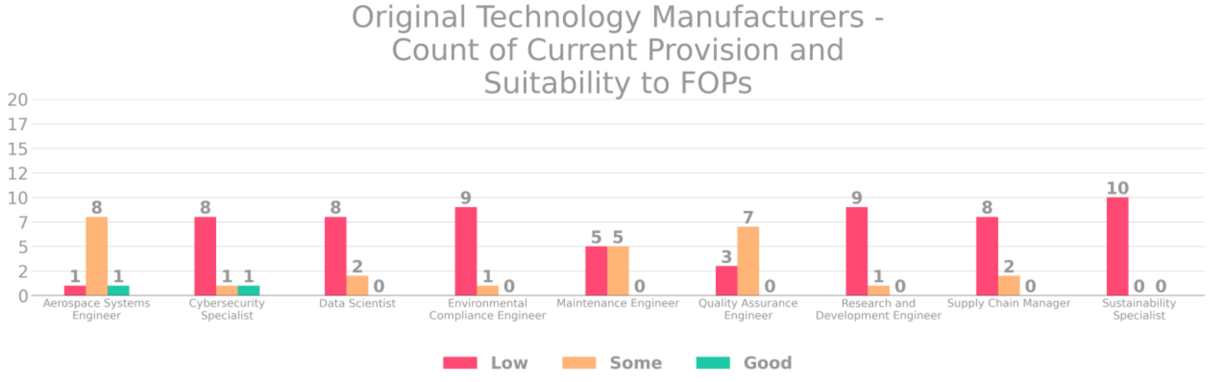


Figure 17: Suitability Summary - Original Technology Manufacturers

Supply Chain Partner - Fuel Infrastructure Providers

Role Level	Selected Future Occupational Profiles	Current Suitability Summary
Junior Level	Quality Assurance Engineer	Some
Junior Level	Training Coordinator	Low
Mid-Level	Cybersecurity Specialist	Low
Mid-Level	Data Scientist	Low
Mid-Level	Environmental Compliance Engineer	Low
Mid-Level	Fuel Infrastructure Design Engineer	Low
Mid-Level	Fuel Infrastructure Operations Engineer	Low
Mid-Level	Infrastructure Planner	Low
Mid-Level	Maintenance Engineer	Low
Mid-Level	Sustainability Specialist	Low
Senior Level	Operations Manager	Low
Senior Level	Risk Manager	Low
Senior Level	Safety and Security Operations Manager	Low
Senior Level	Supply Chain Manager	Low

Table 12: Supply Chain Partner - Fuel Infrastructure Providers

Detailed breakdown:

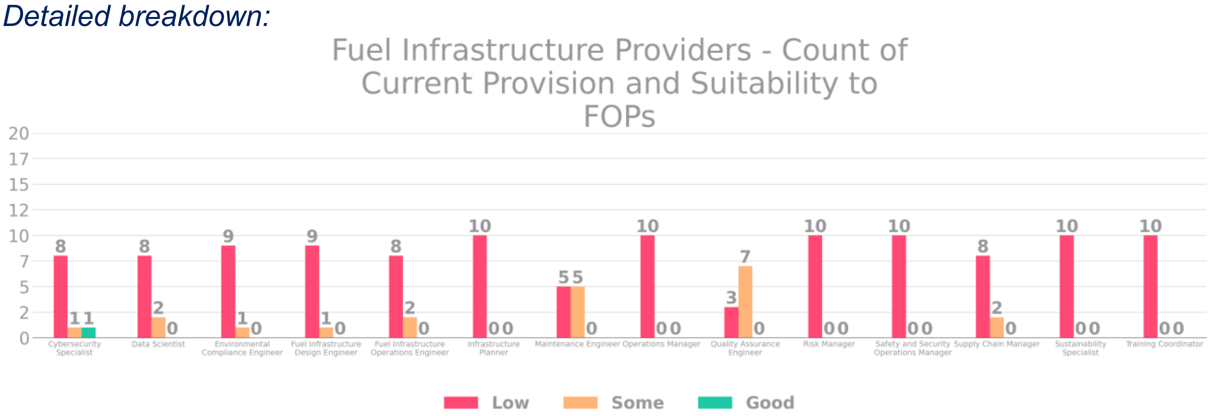


Figure 18: Suitability Summary - Fuel Infrastructure Providers

Supply Chain Partner - Electrical Infrastructure Specialists

Role Level	Selected Future Occupational Profiles	Current Suitability Summary
Junior Level	Maintenance Planner	Low
Junior Level	Quality Assurance Engineer	Some
Junior Level	Training Coordinator	Low
Mid-Level	Cybersecurity Specialist	Low
Mid-Level	Data Scientist	Low
Mid-Level	Environmental Compliance Engineer	Low
Mid-Level	Fuel Infrastructure Design Engineer	Low
Mid-Level	Fuel Infrastructure Operations Engineer	Low
Mid-Level	Infrastructure Planner	Low
Mid-Level	Maintenance Engineer	Low
Mid-Level	Sustainability Specialist	Low
Senior Level	Operations Manager	Low
Senior Level	Supply Chain Manager	Low

Table 13: Supply Chain Partner - Electrical Infrastructure Specialists

Detailed breakdown:

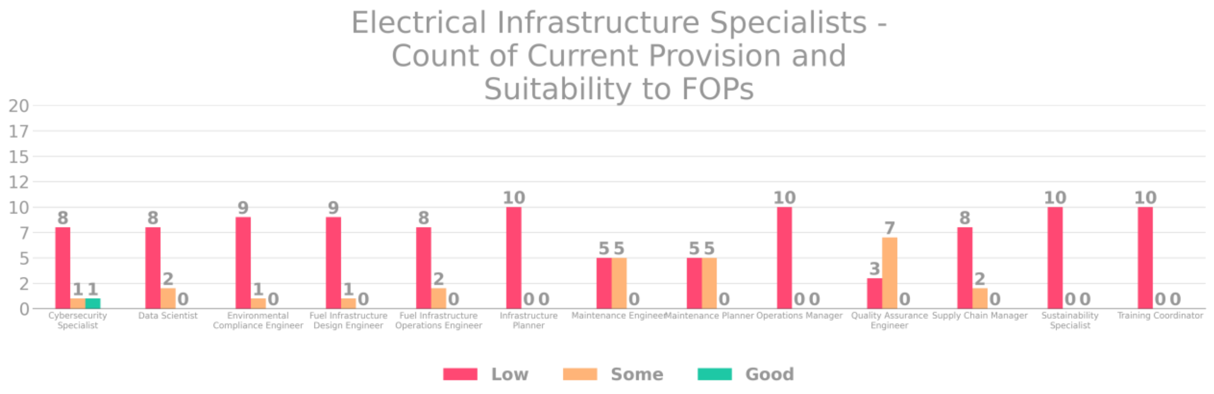


Figure 19: Suitability Summary - Electrical Infrastructure Specialists

Visualisation tool links and descriptions

Visualisation Data Link	What is it and what can it be used for?
FOP Detail	This page allows you to review a specific Occupational Profile, including the capabilities contained within it and the Knowledge, Skills & Behaviour (KSB) tags associated with the capability. You can select an individual Role Level and linked FOP in the two available dropdowns. The table in the lower section of the page will then be populated with all relevant capabilities. The search control above the table allows you to filter content of any of the columns of data. A key piece of functionality in this table is the presence of the KSB tags associated with the capabilities.
Future KSBs Summary	This page provides a view of the complete set of capabilities within the cycle along with all of the associated KSB tags which are linked to them. It is, essentially, the superset of all details displayed on the Fop detail page. This is used to: • To review the identified Knowledge, Skill and Behaviour tags for a given capability, to support development of future education and learning material. • To review the requirements from a capability level, rather than a role level/occupational profile grouping.
Capabilities Matched to Current Provision	This page allows you to review and compare individual capabilities against 'Duty' statements in an Apprenticeship / Occupational Standard. You can select individual capabilities to review their specific matches. These matches are shown in the bottom panel, including the Standard, the Level and the Duty Statement this is matched to. You can filter in several ways to focus your review: • By the Capability Classification Framework (left-hand panel). • By capabilities that **are** served by the reference mapping framework – the default is Institute for Apprenticeships and Technical Education (IfATE) provision. • By capabilities that **are not** served by the reference mapping framework, e.g., IfATE provision – these are capabilities required in the future that may require new/bespoke training and CPD materials to be developed to upskill/re-skill the workforce. This page can be used to identify where existing provision may exist across the broad spectrum of Apprenticeship standards, and not just within a narrow range of sector-specific Standards. The data also allows you to identify where provision may already exist to support specific capabilities.
Fit & Surplus Factors	This page allows you to review the 'Fit' and 'Surplus' of Prototype Future Occupation Profiles (FOP) against existing

Visualisation Data Link	What is it and what can it be used for?
	training provision e.g. Institute for Apprenticeships and Technical Education (IfATE). It is possible for the 'Fit' and 'Surplus' comparison to total over 100%, as they are two separate calculations based on a two-way comparison.
Fit & Surplus Matrix	This page is a visual representation of the 'Fit and Surplus Factor' insight. You can visually review 'Fit' and 'Surplus' of Prototype Future Occupation Profiles (FOP) against existing training provision e.g. Institute for Apprenticeships and Technical Education (IfATE). This can help you identify which provision may align strongest, or which may require adaptation, to provide the suitable provision fit for each future role. It will help you focus in on which provision to focus your attention for analysis.
FOP Capability Matches	This page allows you to view the matches between Capabilities and Institute for Apprenticeships and Technical Education (IfATE) Duty Statements. Clicking the arrow next to a number in the 'Matches' column will open a popup with more detail for each Capability. Each capability also includes Knowledge, Skill and Behaviour Tags, to support with scaffolding future education provision. You can review individual Prototype Future Occupational Profiles (FOPs) or review all FOPs under a Role Level, to give a more holistic view of Capabilities and Matches Where a future capability has been matched to existing provision (currently, by default, IfATE apprenticeship standards) it is possible to interrogate the data and identify specific statements in standards that align to enable identification of existing training materials and activities that could be used or adapted to meet future requirements. This can be used to review the capability requirements for Role Levels and FOPs, from Job / Occupation level through to Knowledge, Skill and Behaviour level

Table 14: Visualisation tool links and descriptions

4. Conclusion and Next Steps

4. Conclusion and Next Steps

4.	Conclusions and Next Steps
4.1	Summary of key insights
4.2	What this means for Industry and the Workforce
4.3	What this means for Education
4.4	Recommended next steps

4.1 Summary of Key Insights

The workforce foresighting cycle has produced definitive findings that illuminate the scale and urgency of capability transformation required within the UK aviation sector. The analysis confirms that the sector is not currently equipped to support the safe and scalable deployment of hydrogen, electric, and SAF infrastructure systems essential for meeting national Net Zero commitments.

The prioritised technology solution - cyber-physical security systems for multi-fuel infrastructure - demands an unprecedented integration of digital and operational capabilities that fundamentally challenge existing occupational frameworks. Current training provision and occupational standards fail to reflect the sophisticated competency integration required for managing systems where information technology, operational technology, and alternative fuel handling converge within complex safety-critical environments.

The foresighting process revealed systematic workforce readiness gaps across all six identified supply chain partner groups, with particularly acute deficiencies in hydrogen safety protocols, operational technology cybersecurity, and emergency response coordination for multi-fuel environments. These gaps extend beyond simple skills shortages to encompass fundamental misalignments between existing educational frameworks and emerging operational requirements.

These insights prove critical for ensuring the UK can achieve its Jet Zero Strategy targets while maintaining global leadership in sustainable aviation innovation. The compressed deployment timeline between current capability levels and 2030 transformation requirements creates unprecedented urgency for coordinated workforce development action across industry, education, and regulatory domains.

The analysis highlighted several unexpected findings that challenge conventional assumptions about workforce transition pathways and training system adaptability. Despite the recognised strategic importance of hydrogen and SAF technologies, most Future Occupational Profiles (FOPs) developed through the foresighting cycle demonstrated low suitability against current Institute for Apprenticeships and Technical Education (IfATE) apprenticeship standards.

This misalignment proves particularly pronounced for emerging roles, including Fuel Infrastructure Engineer, Sustainability Specialist, and Cybersecurity Specialist, which represent rapidly expanding employment categories yet lack formal pathways for training and recruitment. These roles require competency combinations that span traditional occupational boundaries, creating challenges for existing qualification frameworks designed around discrete professional domains.

The limited integration of cybersecurity expertise within aviation operational contexts emerged as a particularly significant gap, especially given the escalating cyber-physical risks associated with multi-fuel systems. Current aviation training emphasises physical safety and operational procedures while treating cybersecurity as a separate domain, although future operations will require seamless integration of both competency areas.
These findings suggest that traditional approaches to curriculum evolution and professional development prove inadequate for the pace and complexity of transformation required. Without urgent curriculum reform initiatives and targeted continuing professional development programs, the sector faces substantial risks of delayed deployment timelines and regulatory non-compliance.

The contrast between technological readiness and workforce preparedness highlights a fundamental strategic challenge: while engineering solutions for sustainable aviation demonstrate increasing maturity, the human capital systems required to deploy and operate these technologies remain critically underdeveloped.

The foresighting cycle benefited from comprehensive stakeholder engagement spanning industry, education, and technology domains, creating a robust foundation for insights development and validation. Key participants included London Luton Airport as the sponsoring organisation, Connected Places Catapult serving as convenor, and academic institutions including the Universities of Kent, Sheffield, Cranfield, and Highlands and Islands, alongside industry specialists from Clyde Hydrogen and the South West Cyber Security Cluster.
This multi-stakeholder approach enabled comprehensive integration of perspectives while identifying collaboration opportunities and coordination challenges across sector boundaries. The engagement process revealed both the complexity of stakeholder coordination requirements and the substantial expertise available for supporting transformation initiatives when effectively mobilised.

Cross-sector working group requirements emerged as a critical finding through discussions with trade associations, regulatory bodies, and industrial standards organisations. These discussions highlighted the essential need for coordinated approaches to occupational standards alignment, safety protocol development, and digital infrastructure requirements that transcend traditional industry boundaries.
The complexity of cyber-physical systems for multi-fuel infrastructure demands collaboration between aviation, cybersecurity, energy, and regulatory expertise that historically operated independently. Effective deployment requires new coordination mechanisms that facilitate knowledge transfer and standard development across these diverse professional communities.

Education stakeholder engagement revealed both opportunities and challenges for curriculum adaptation and evolution of the delivery system. Educational institutions demonstrated willingness to adapt existing provision to support emerging requirements, while simultaneously highlighting critical needs for clear guidance on emerging role profiles, modular curriculum design approaches, and dedicated funding support for new qualification development.
This educational readiness, combined with identified guidance and resource requirements, suggests that coordinated action can accelerate curriculum development and adaptation of the training delivery system. However, success requires sustained coordination between industry requirements definition, educational delivery system development, and regulatory framework evolution.

The stakeholder engagement process confirmed that the technical expertise and institutional capacity required for workforce transformation exist within the UK system but require unprecedented coordination and resource alignment to achieve the scale and pace of change demanded by national Net Zero commitments and competitive positioning requirements.
The below table counts the number of IfATE standards by suitability score for each FOP. For the purpose of this report, we’ve utilised the suitability grid to highlight the top IfATE standards that support each FOP. The table identifies if they have low, some or high suitability and colour-coded their overall suitability.

The table below counts the number of IfATE standards by suitability score for each FOP. For the purpose of this report, we've utilised the suitability grid to highlight the top IfATE standards that support each FOP. The table identifies if they have low, some or high suitability and colour-coded their overall suitability.

Role Level	Primary Supply Chain / Supply Chain Partner	Future Occupation Profile	Overall Suitability RAG
Junior Level	Airport Operators, Electrical Infrastructure Specialists	Maintenance Planner	Good
Junior Level	Airport Operators, Fuel Infrastructure Providers, Electrical Infrastructure Specialists	Training Coordinator	Low
Junior Level	Fuel Developers / Suppliers, Original Technology Manufacturers, Fuel Infrastructure Providers, Electrical Infrastructure Specialists	Quality Assurance Engineer	Low
Mid-Level	Airport Operators, Fuel Infrastructure Providers, Electrical Infrastructure Specialists	Infrastructure Planner	Low
Mid-Level	Fuel Developers / Suppliers, Airport Operators	Energy Market Analyst	Low
Mid-Level	Fuel Developers / Suppliers, Airport Operators, Fuel Infrastructure Providers, Electrical Infrastructure Specialists	Fuel Infrastructure Design Engineer	Low
Mid-Level	Fuel Developers / Suppliers, Airport Operators, Fuel Infrastructure Providers, Electrical Infrastructure Specialists	Fuel Infrastructure Operations Engineer	Low
Mid-Level	Fuel Developers / Suppliers, Airport Operators, Original Technology Manufacturers, Fuel Infrastructure Providers, Electrical Infrastructure Specialists	Cybersecurity Specialist	Some
Mid-Level	Fuel Developers / Suppliers, Airport Operators, Original Technology Manufacturers, Fuel Infrastructure Providers, Electrical Infrastructure Specialists	Environmental Compliance Engineer	Low
Mid-Level	Fuel Developers / Suppliers, Airport Operators, Original Technology Manufacturers, Fuel Infrastructure Providers, Electrical Infrastructure Specialists	Maintenance Engineer	Some
Mid-Level	Fuel Developers / Suppliers, Airport Operators, Regulators (CP Air), Original Technology Manufacturers, Fuel Infrastructure Providers, Electrical Infrastructure Specialists	Sustainability Specialist	Low
Mid-Level	Fuel Developers / Suppliers, Original Technology Manufacturers	Research and Development Engineer	Low
Mid-Level	Fuel Developers / Suppliers, Original Technology Manufacturers, Fuel Infrastructure Providers, Electrical Infrastructure Specialists	Data Scientist	Low
Senior Level	Original Technology Manufacturers	Aerospace Systems Engineer	Good
Senior Level	Airport Operators, Regulators (CP Air), Fuel Infrastructure Providers	Safety and Security Operations Manager	Low
Senior Level	Fuel Developers / Suppliers, Airport Operators	Emergency Response Coordinator	Good

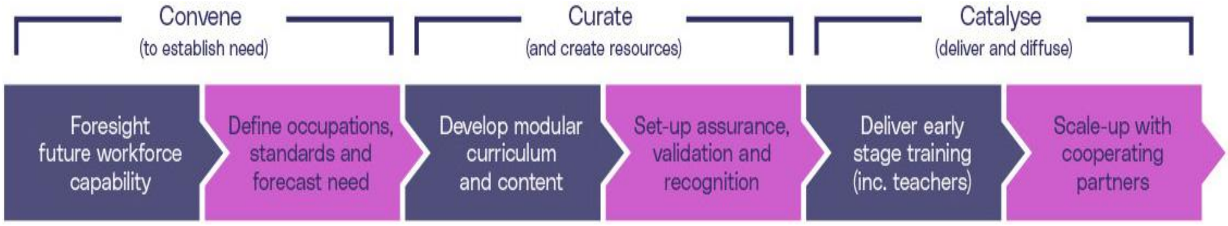
Role Level	Primary Supply Chain / Supply Chain Partner	Future Occupation Profile	Overall Suitability RAG
Senior Level	Fuel Developers / Suppliers, Airport Operators, Fuel Infrastructure Providers, Electrical Infrastructure Specialists	Operations Manager	Low
Senior Level	Fuel Developers / Suppliers, Airport Operators, Original Technology Manufacturers, Fuel Infrastructure Providers, Electrical Infrastructure Specialists	Supply Chain Manager	Low
Senior Level	Fuel Developers / Suppliers, Airport Operators, Regulators (CP Air)	Regulatory Compliance Officer	Some
Senior Level	Fuel Developers / Suppliers, Airport Operators, Regulators (CP Air), Fuel Infrastructure Providers	Risk Manager	Low

Table 15: IfATE standards by suitability score for each FOP

4.2 What this means for Industry and the Workforce

Collective Action

Foresighting has been developed to provide insight and the detailed information required to enable action by relevant stakeholders but is the first step of the Skills Value Chain. Collective action will be required by all stakeholders to ensure that the changes identified by foresighting – to the supply chain, the workforce and education provision are implemented.



The complexity of cyber-physical security systems for multi-fuel infrastructure transcends individual organisational capabilities, requiring unprecedented coordination between employers, educational institutions, regulatory bodies, and technology providers. Success depends not on isolated initiatives but on synchronised action that aligns capability development with deployment timelines and regulatory requirements.

This coordination challenge is intensified by the compressed timeline between current workforce capabilities and the 2030 transformation requirements. Traditional approaches to workforce development, characterised by sequential planning and gradual implementation, prove inadequate for the pace and scale of change demanded by national Net Zero commitments and competitive positioning objectives.

Employers in the aviation and airport infrastructure sector must embrace proactive strategies that operate simultaneously at individual organisational and collective industry levels to ensure skilled professional development aligns with future operational and regulatory demands. Upskilling and reskilling investments represent immediate priorities, particularly targeting existing staff development in hydrogen safety protocols, operational technology cybersecurity, and emergency response coordination for multi-fuel environments. These programs must bridge the gap between current competencies and emerging requirements while maintaining operational continuity during the transition period.

The integration of digital and physical system expertise requires training approaches that transcend traditional professional boundaries. Staff development programs must cultivate an understanding of cyber-physical interactions rather than treating cybersecurity and operational safety as separate domains.

Early pipeline development demands sustained collaboration with schools, colleges, and universities to foster interest in emerging aviation roles while creating clear career pathways into the sector. This engagement must extend beyond traditional recruitment approaches to encompass curriculum influence, work experience programs, and research collaboration initiatives.

Educational partnership development should emphasise the interdisciplinary nature of future aviation roles, highlighting opportunities for students with diverse academic backgrounds, including cybersecurity, engineering, sustainability, and regulatory compliance specialisations.

Technical collaboration through cross-functional working groups and interface design teams addresses the complex integration challenges associated with digital and physical system convergence. This collaboration must commence early in project lifecycles, particularly during infrastructure design and planning phases, to ensure workforce requirements are embedded within system specifications rather than treated as implementation afterthoughts.
Working group effectiveness depends on sustained participation from fuel developers, airport operators, regulators, manufacturers, infrastructure providers, and electrical specialists, creating forums for knowledge transfer and standard development across traditional industry boundaries.

Strategic workforce planning utilising foresighting outputs enables systematic review of organisational capability changes while planning for workforce transitions across entire supply chains. This planning must encompass both direct employment and contractor capability requirements, ensuring that transformation initiatives address all operational dependencies.

Organisational planning should anticipate not only new role requirements but also the evolution of existing positions, recognising that current job functions will require substantial competency expansion to support cyber-physical security systems and multi-fuel operations. The transition to multi-fuel ecosystems will fundamentally reshape job roles across the aviation sector, demanding new competencies in systems integration, regulatory compliance, and digital resilience that extend far beyond traditional operational expertise. This transformation affects not only specialised technical roles but also management, administrative, and support functions that must develop an understanding of cyber-physical security principles and multi-fuel operational requirements.

Coordination planning becomes essential to prevent infrastructure deployment delays, safety incidents, and regulatory non-compliance that could emerge from inadequate workforce preparation. The interconnected nature of cyber-physical systems means that capability gaps in any stakeholder category can compromise entire operational ecosystems.
The sector faces a critical decision point: immediate action to align workforce development with transformation requirements, or acceptance of delayed deployment timelines and increased operational risks associated with inadequate human capital preparation.

Employer action urgency reflects the reality that workforce development initiatives require substantial lead times to achieve effectiveness, while technology deployment schedules remain compressed by climate commitments and competitive pressures. Organisations that initiate workforce development programs immediately position themselves advantageously for successful technology adoption, while those that delay action risk operational disruption and competitive disadvantage.

The scale and complexity of future fuel systems demand workforce capabilities that cannot be developed through conventional training approaches or recruitment from existing labour markets. Success requires coordinated industry action that creates entirely new career pathways while transforming existing professional roles to support cyber-physical security systems and multi-fuel operations.

This transformation represents both a significant challenge and a strategic opportunity for UK aviation leadership. Organisations that embrace comprehensive workforce development initiatives will establish competitive advantages in sustainable aviation markets while contributing to national Net Zero objectives and industrial competitiveness goals.

4.3 What this means for Education

The foresighting cycle has identified critical workforce development requirements that demand immediate and coordinated response from education providers across further education, higher education, and professional development sectors. While existing qualifications provide foundational elements, the analysis reveals that most Future Occupational Profiles (FOPs) demonstrate low suitability against current apprenticeship standards, creating urgent imperatives for curriculum adaptation and delivery system evolution.

The findings indicate that future workforce needs can be effectively addressed through strategic modifications to existing courses and degrees rather than complete program redesign. This approach offers significant advantages in implementation speed and resource efficiency while maintaining alignment with established educational frameworks and quality assurance processes.

Modular curriculum development emerges as the preferred approach, proving more achievable within required timescales compared to wholesale course design initiatives. This modular strategy enables rapid deployment of targeted competency development while preserving the flexibility to adapt content as technology deployment and regulatory frameworks evolve.

The dominant focus on systems integration engineering within cycle findings reflects the cyber-physical nature of future aviation infrastructure. At the same time, stakeholder groups emphasised the essential mechanical engineering content required for safe multi-fuel operations. This dual emphasis highlights the interdisciplinary competency requirements that must be embedded within curriculum development initiatives.

Education modules for higher education and further education courses should be developed with direct reference to the Priority Future Occupational Profiles (P-FOPs) and capability sets spanning electrical, mechanical, and systems integration engineering domains. This reference-based approach ensures that curriculum content directly addresses identified capability gaps while maintaining coherent educational progression.

Standards identified through fit-surplus factor analysis offer additional adaptation opportunities, particularly for power transmission, maintenance technicians, and production/manufacturing technicians that provide foundational competencies for multi-fuel infrastructure operations.

Education providers must focus on mapping existing capabilities to current provision using Fit & Surplus analysis tools and visualisation resources to identify adaptation opportunities and new module requirements. This mapping exercise enables strategic resource allocation and prevents unnecessary duplication of existing content.

Continuing professional development and short course development represent immediate priorities, particularly targeting current professionals in airport operations, emergency response, and infrastructure planning who require rapid competency enhancement to support technology deployment timelines.

New pathway creation for emerging roles, including cyber-physical systems engineers, hydrogen safety technicians, and regulatory compliance officers, demands innovative approaches that bridge traditional academic boundaries while maintaining professional relevance and industry recognition.

Future roles demonstrate unprecedented convergence across electrical, mechanical, systems integration, and digital domains, requiring curriculum development that reflects this interdisciplinary reality rather than maintaining traditional subject boundaries. Educational programs must cultivate an understanding of cyber-physical interactions alongside domain-specific technical competencies.

This integration challenge extends beyond curriculum content to encompass delivery approaches, assessment methods, and faculty development requirements. Educational institutions must develop capabilities for teaching integrated competencies rather than discrete subject areas.

The cybersecurity-operational technology integration proves particularly challenging for educational providers, requiring expertise that spans information technology, operational technology, and sector-specific safety protocols. This integration demands new faculty competencies and industry partnership approaches.

University-industry collaboration must evolve beyond traditional placement and guest lecture models to encompass comprehensive module co-design and continuous curriculum relevance validation. These partnerships ensure that educational content reflects operational requirements while anticipating future technology evolution.

Effective collaboration requires sustained engagement between academic program leaders and industry practitioners, creating feedback mechanisms that enable rapid curriculum adaptation in response to technological and regulatory changes.
Specialist technical capability development should be addressed through targeted PhD sponsorships and enhanced industry engagement, particularly for highly technical domains including hydrogen systems integration and operational technology cybersecurity. University-led doctoral research can investigate complex problems and emerging technologies before industry professionals and research organisations provide support for solution refinement and scaling.

The compressed deployment timeline between current educational provision and 2030 workforce requirements demands immediate action from education providers while maintaining quality standards and regulatory compliance. The scale of curriculum adaptation required across multiple educational institutions and program types necessitates coordinated action through sector bodies, professional institutions, and regulatory agencies to ensure consistency and transferability of qualifications.

4.4 Recommended next steps

The workforce foresighting cycle has generated definitive insights into the critical capability gaps threatening the UK aviation sector's transition to sustainable fuel ecosystems. We must now orchestrate the systematic transition from strategic insight to operational implementation across the Skills Value Chain.

The compressed timeline between current workforce capabilities and 2030 deployment requirements demands immediate, coordinated action that transcends traditional organisational boundaries. Success depends not on isolated initiatives but on synchronised stakeholder engagement that aligns capability development with technology deployment schedules and regulatory compliance requirements. We propose a two-pronged approach:

- Establish a comprehensive working group comprising all critical stakeholder categories from the foresighting cycle. This must include employer representatives from London Luton Airport, fuel suppliers, and infrastructure providers; educational institutions including the Universities of Kent, Sheffield, Cranfield, and Highlands and Islands; technology specialists from organisations such as Clyde Hydrogen and the South West Cyber Security Cluster; and strategic partners encompassing IfATE, Innovate UK, and relevant Catapult Centres. The working group's primary purpose centres on validating foresighting findings, prioritising workforce development actions, and coordinating delivery mechanisms while ensuring sustained stakeholder engagement throughout implementation phases.
- Comprehensive FOP validation must utilise available visualisation tools to confirm capability groupings and proficiency level specifications while engaging employers to assess realistic demand forecasts. This validation process should align FOPs with evolving regulatory frameworks and operational requirements, ensuring that workforce development initiatives support both technology deployment and compliance obligations. Employer engagement throughout validation ensures that FOP specifications reflect actual operational requirements rather than theoretical competency frameworks.

Additional foresighting cycles should be considered for complementary technology domains, including electric aircraft infrastructure, hydrogen logistics and supply chain resilience, and regulatory technology and compliance systems. This expanded approach would provide comprehensive workforce intelligence across the entire sustainable aviation ecosystem while informing broader transport and energy sector workforce planning initiatives.

The success of this transformation depends on leveraging Future Occupational Profiles to address current and anticipated skill gaps through targeted industry standard updates and continuing professional development course creation. Collaborative content development between educators, awarding bodies, and employers must tailor course content to align with new capability requirements, while cross-sector recruitment approaches accelerate workforce availability by bringing diverse perspectives and complementary expertise to aviation transformation challenges.

Continuous review of educational standards and qualifications in partnership with employers ensures ongoing alignment between educational provision and operational requirements. Establishing a working group for action plan creation and stakeholder communication ensures that findings influence workforce development initiatives while maintaining strategic alignment across organisational boundaries.

Failure to implement these recommendations will result in the UK aviation sector falling critically behind in its transition to sustainable fuel ecosystems. Workforce readiness delays will systematically stall infrastructure deployment, increase operational safety risks, and fundamentally undermine the UK's ability to meet Net Zero commitments while maintaining global leadership in sustainable aviation innovation.

The window for effective action is rapidly narrowing as deployment timelines accelerate and regulatory requirements intensify. Organisations that delay workforce development initiatives risk operational disruption, regulatory non-compliance, and competitive disadvantage that may prove difficult to recover within the compressed transformation timeline.

The contrast between the sector's transformational ambitions and current workforce capabilities creates both significant risks and untapped opportunities. Organisations that embrace comprehensive workforce development initiatives will establish competitive advantages in sustainable aviation markets while contributing to national climate objectives and industrial leadership goals. The foresighting cycle has provided the intelligence required for effective action – success now depends on sustained stakeholder commitment to implementation excellence and collaborative capability development across the entire Skills Value Chain.

Appendix

Appendices

Section	Title
A	List of participants
B	Cycle timeline
C	Access to output data - link and authorisation
D	Glossary - common language
E	Visualisation links and illustrations

A. List of Participants

Industry Participants	Skills Participants	Technology Participants
Barnaby Nash – London Luton Airport	Darren Hurley-Smith - University of Kent	Tim Parker - South West Cyber Security Cluster
Nicole Walker – London Luton Airport	Lenny Koh – University of Sheffield	Matt Lees – Clyde Hydrogen
	Andrew Rae - University of the Highlands and Islands	Ash Gifford – Connected Places Catapult
	Upul Kahagala Gamage – Cranfield University	

B. Cycle timeline

Workforce Foresighting cycle started the Carry Out phase in February 2025. The Carry Out phase concluded in May 2025. The Findings report was prepared following the data validation period and published in May 2025

C. Access to output data - link and authorisation

Data Capture Overview

Full URL https://hvmcatapultforesighting.retool.com/embedded/public/e869283b-4b8a-437c-973e-64ab292e5b87?_environment=production&token=8953f841a9b37a93b0f3ebc5c4f68c4b

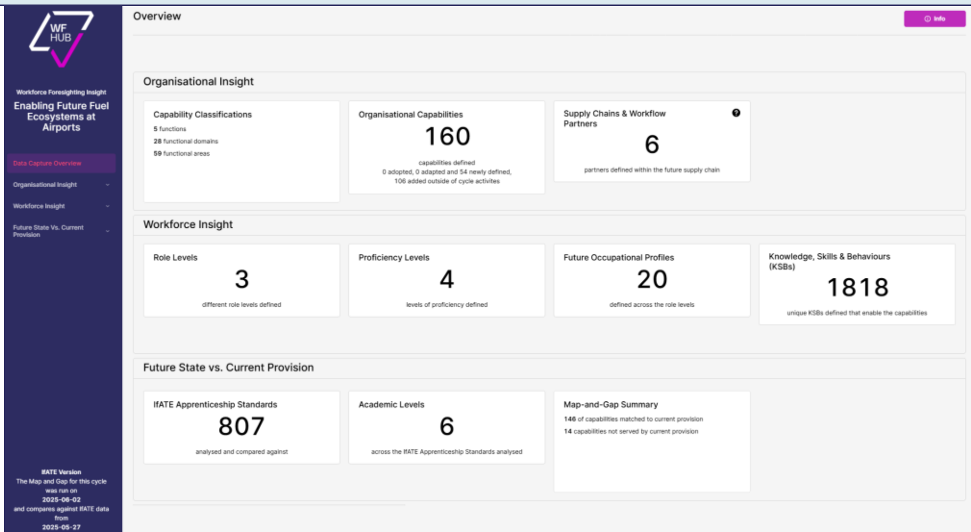
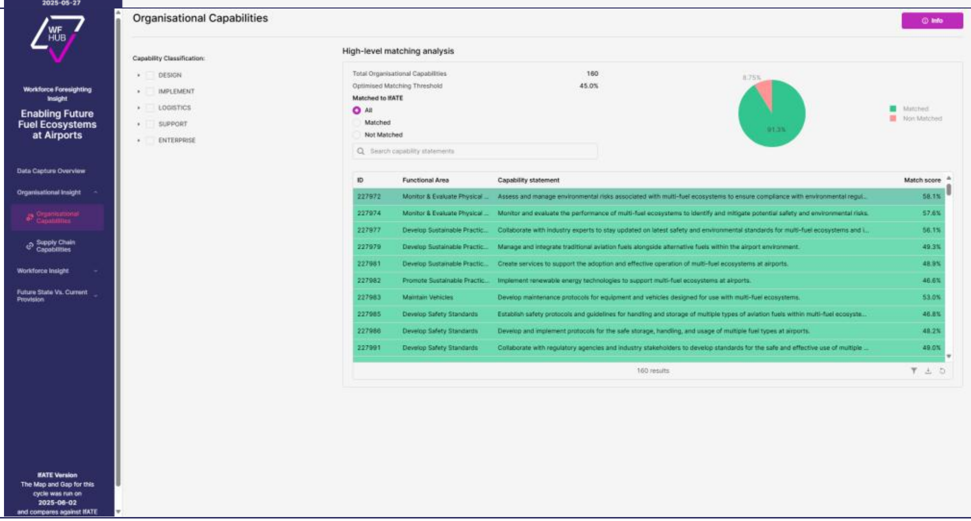
D. Glossary - common language

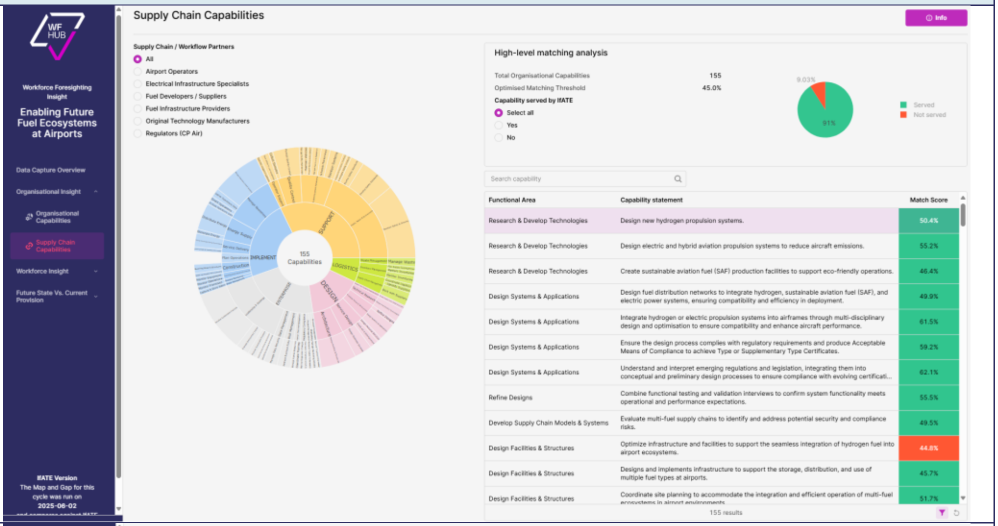
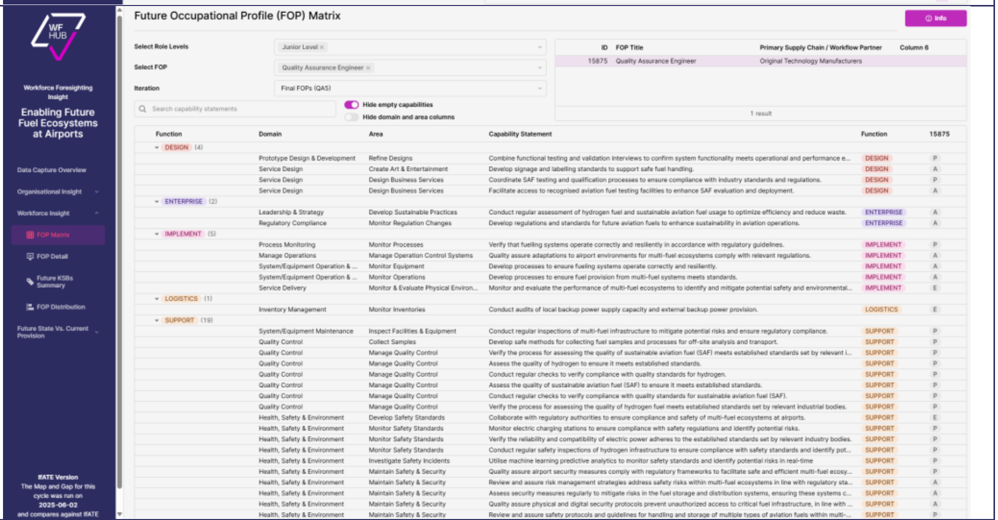
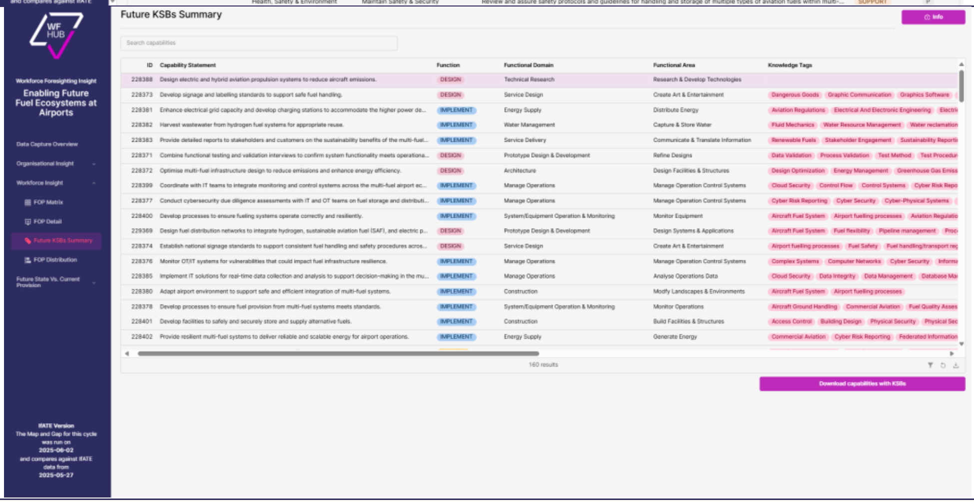
Term	Definition
Impact Domains	Innovate UK domains used as Strategic Categories to assist setting and monitoring priorities
National Challenge (Industry / Sector / Region)	A recognised technological or socio-political threat or opportunity for which there is consensus that workforce action is necessary
Challenge Response	Specific intervention aimed at the challenge
Capability (Organisation)	The collective abilities, and expertise of an organisation to carry out a function, because provision and preparation have been made by the organisation
Capability Classification	Classification provides a common, structured vocabulary to define capability
Capability Statements	Description of the depth and nature of each capability within an organisation
Capability Syntax	Common language to describe each capability application within organisation type
Competencies (Workforce / Individual)	'Proficiency, aptitude, capacity, skill, technique, experience, expertise, facility, fitness related to capability
Competency definition 'KSBs' (Knowledge, Skills and Behaviours)	Knowledge, Skills, and Behaviours are the elements used to express the required competencies for each Role Group
Competency Domain	Used during foresighting analysis to provide focus on existing and emerging competency needs
Delphi Process	Foresighting takes a Delphi approach which has come to represent consulting expert opinion. (Harking back to the Delphic Oracle of ancient Greece)
Foresight Cycle	Set of workshops, analysis and reporting that implements the Foresight Process for each subject
Foresight Process	A series of activities which are convened to understand future competence needs, the opportunities available and actions required to deliver the right skills at the right time and place
Foresighting Champion	An individual nominated within a new user organisation of foresighting to facilitate and lead the use of foresighting processes and tools with the support of the Project Team
Foresighting Subject	The application of specific technologies in the context of a given challenge and which are candidates for foresighting
Future Competency Set	The KBS output from the Educator workshop for each Role Group
Map and Gap Analysis	A combined expert and automated process that maps the Future Competency Set against a selected reference framework
Organisation Type	Simple description of nature of organisation for which capability is required
Proficiencies	Proficiencies differentiate the degree of competencies required from differing Role Groups to support capabilities
Project Sponsor	Typically, a stakeholder in the challenge being successfully met who requires information to under-write plans to act

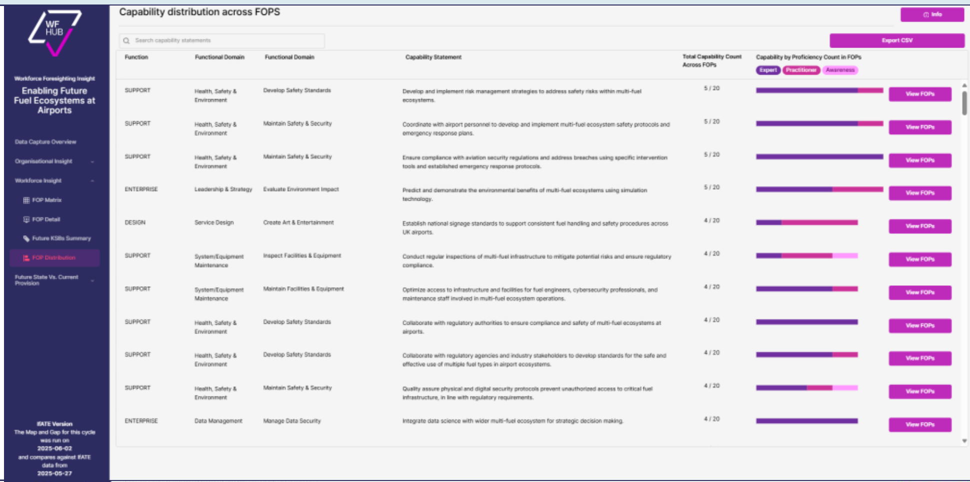
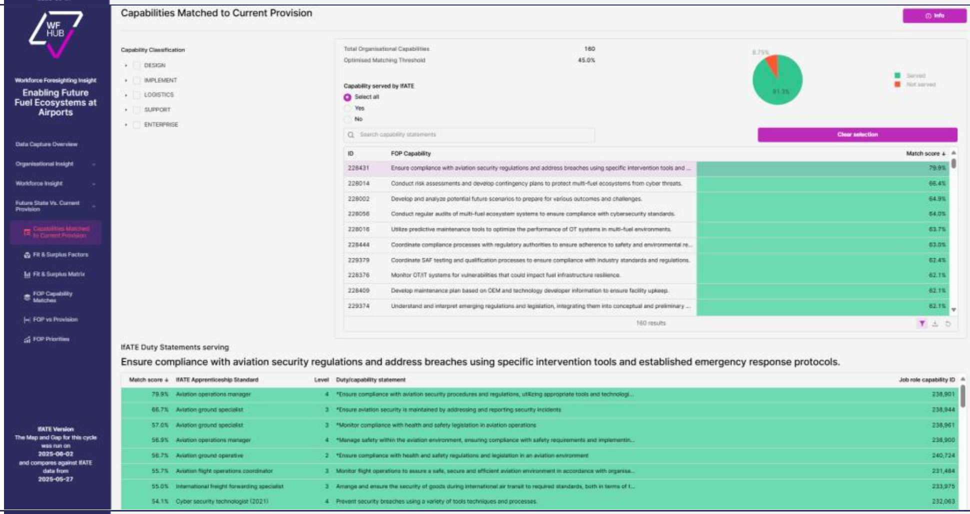
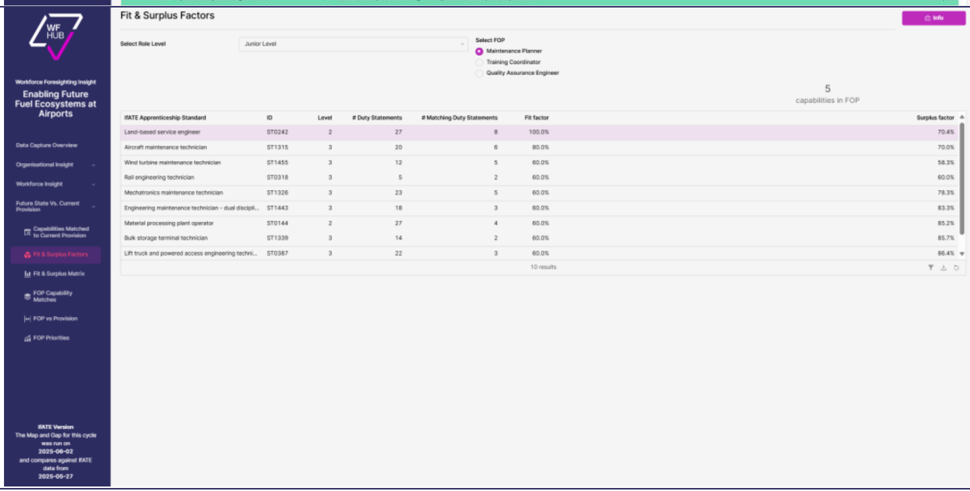
Role Group	Role groups are a collective of roles that exist in a typical manufacturing business / industrial sector
Syntax	The way in which a statement is phrased to ensure reliable, repeatable and meaningful interpretation
Technologies	The technology that could be used to address the challenge
Working Scenario	To provide further context in relation to the subjects and used to position participants thinking during the detailed identification of future capabilities
Workshops	Online sessions used to undertake each step in the foresight process
Roadmaps	Sector, Industry, Regional view of emerging opportunities and their market entry
Participants	Technologists, Educators, Employers

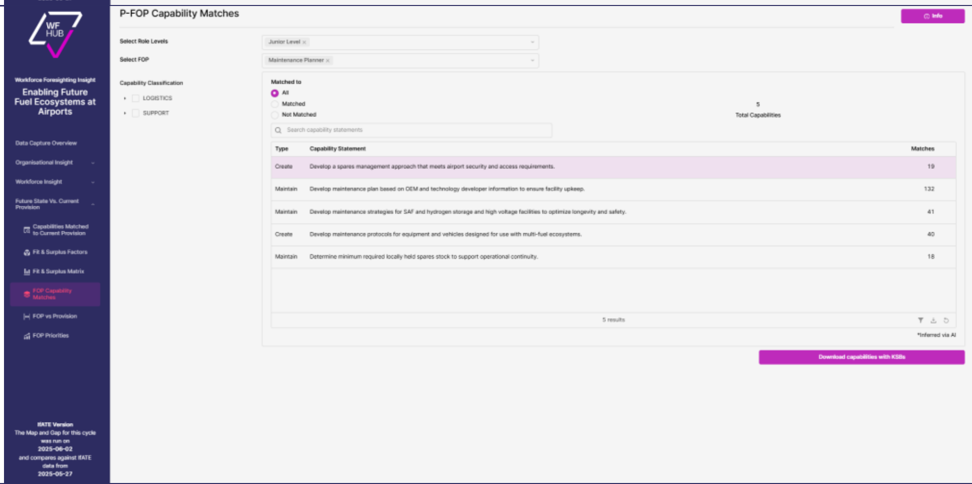
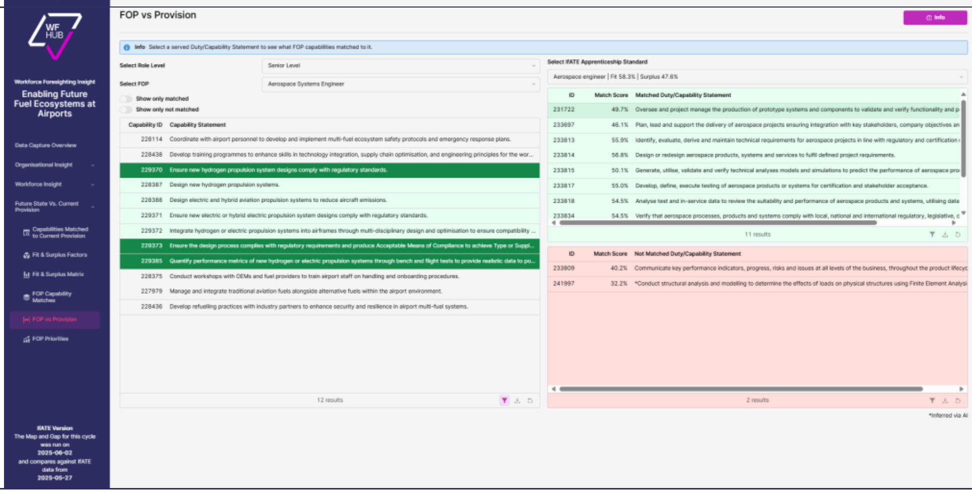
E. Visualisation links and Illustrations

Images are not cycle specific and just for guidance purposes

Link to Visualisation	View of data
Data Capture Overview	
Organisational Capabilities	

Link to Visualisation	View of data
Supply Chain Capabilities	
FOP Matrix	
Future KSBs Summary	

Link to Visualisation	View of data
FOP Distribution	
Capabilities Matched to Current Provision	
Fit & Surplus Factors	

Link to Visualisation	View of data
Fit & Surplus Matrix	
FOP Capability Matches	
FOP vs Provision	

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<tr><th>Link to Visualisation</th><th>View of data</th></tr>
<tr><td>FOP Priorities</td><td>


<table>
<tr><th>Role Level</th><th>FOP Title</th><th>FOP Co...</th><th>Primary Supply Chain</th><th>Max. Fit Fa...</th><th>Associated Surplus Fac...</th><th>Job Role Title</th><th>Job role ID</th></tr>
<tr><td>Junior Level</td><td>Maintenance Planner</td><td>15870</td><td>Airport Operators</td><td>100.0%</td><td>70.4%</td><td>Land-based service engineer</td><td>14496</td></tr>
<tr><td>Senior Level</td><td>Emergency Response Coordinator</td><td>15869</td><td>Airport Operators</td><td>83.3%</td><td>87.5%</td><td>Harbour master</td><td>13928</td></tr>
<tr><td>Senior Level</td><td>Aerospace Systems Engineer</td><td>15885</td><td>Original Technology Manufacturers</td><td>75.0%</td><td>46.7%</td><td>Power and propulsion gas turbine engineer</td><td>13810</td></tr>
<tr><td>Mid-Level</td><td>Cybersecurity Specialist</td><td>15878</td><td>Airport Operators</td><td>67.7%</td><td>47.8%</td><td>Cyber security technologist (2021)</td><td>13875</td></tr>
<tr><td>Senior Level</td><td>Regulatory Compliance Officer</td><td>15884</td><td>Regulators (CP Air)</td><td>57.1%</td><td>66.7%</td><td>Aerospace engineer</td><td>14128</td></tr>
<tr><td>Mid-Level</td><td>Maintenance Engineer</td><td>15877</td><td>Airport Operators</td><td>53.3%</td><td>70.6%</td><td>Through life engineering services specialist (integrated degree)</td><td>13822</td></tr>
<tr><td>Senior Level</td><td>Supply Chain Manager</td><td>15874</td><td>Airport Operators</td><td>50.0%</td><td>11.1%</td><td>Supply chain leadership professional (integrated degree)</td><td>13951</td></tr>
<tr><td>Mid-Level</td><td>Data Scientist</td><td>15866</td><td>Original Technology Manufacturers</td><td>50.0%</td><td>88.2%</td><td>Through life engineering services specialist (integrated degree)</td><td>13822</td></tr>
<tr><td>Junior Level</td><td>Quality Assurance Engineer</td><td>15875</td><td>Original Technology Manufacturers</td><td>48.4%</td><td>61.3%</td><td>Food industry technologist</td><td>14483</td></tr>
<tr><td>Mid-Level</td><td>Environmental Compliance Engineer</td><td>15876</td><td>Fuel Developers / Suppliers</td><td>48.3%</td><td>82.6%</td><td>Facilities manager</td><td>14479</td></tr>
<tr><td>Mid-Level</td><td>Research and Development Engineer</td><td>15867</td><td>Original Technology Manufacturers</td><td>46.2%</td><td>40.0%</td><td>Power and propulsion gas turbine engineer</td><td>13810</td></tr>
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</td></tr>
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Table 16: Visualisation links and Illustrations