


Advanced Media Production: foresighting skills for the future

Digital Catapult
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1. Executive summary

Advanced Media Production is a novel methodology gaining traction across sectors from high-end television to manufacturing simulations, combining many technologies and methodologies to provide innovation across the creative sector. Advanced Media Production refers to the use of motion and camera tracking, LED screens and real-time rendering engines (often referred to as 'game engines') to enable live-action and advanced media elements (such as sets, characters and effects) to be captured. This allows creative teams and actors to envisage what a final shot will look like on the day, rather than waiting for a long post-production process to complete.

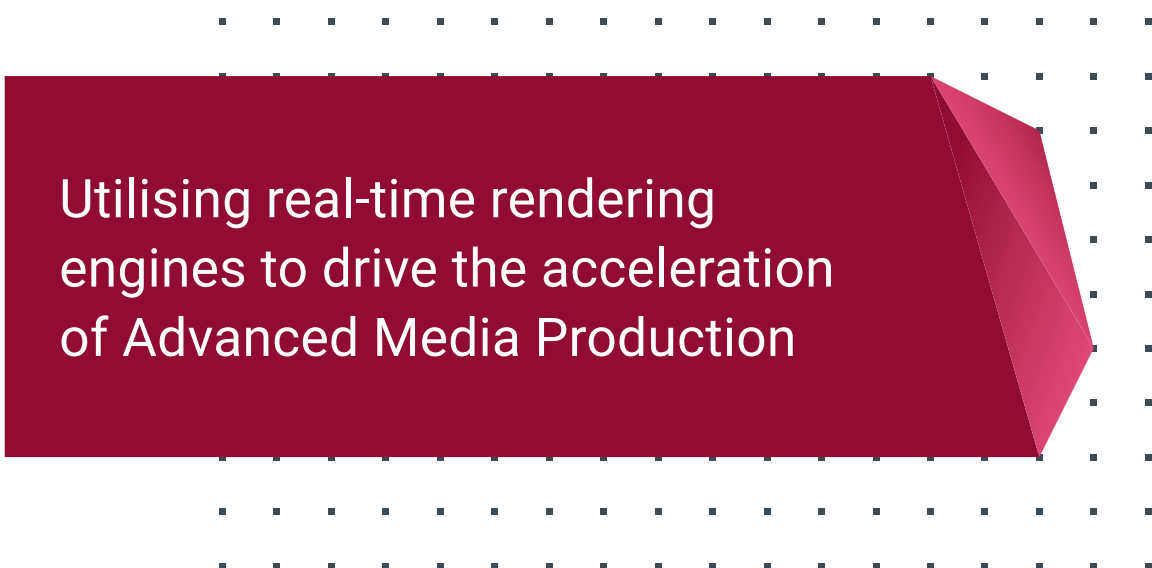
Advanced Media Production pushes the boundaries of existing workflows and use cases enabled by virtual production (VP) through the use of virtualising technologies to create digital environments (through real-time game-engine technology). It combines a technology stack from artificial intelligence (AI) tools and techniques, advanced infrastructure (5G/6G), the internet of things (IoT), and immersive technologies, alongside game-engine technologies and traditional screen media production tools, to deliver innovative cross-sector experiences.

The growing use of VP technologies, combined with the ever-evolving use and workflow of Advanced Media Production across sectors and thriving CreaTech sector, means it is ever more important to make sure investments in this space are being made to improve research and development (R&D) infrastructure, and that the relevant skills capacity is developed to increase adoption and continued growth. Given the pace at which the technologies that make up the Advanced Media Production workflow are evolving, it is increasingly important to think about building a future workforce that will be able to respond to and take forward innovation happening now.



This report has been developed in the context of Digital Catapult and Target3D building a unique Advanced Media Production infrastructure in the UK. A first in Europe, the partnership has seen the development of two facilities, in Tees Valley and London, connected via a high-speed 10 gigabit (Gb) line, to enable real time production across two sites. This will link the two regions, extending existing creative and technical capabilities at the intersection of game-engine technologies and the screen industries, developing unique R&D and commercial opportunities for the future.¹

Digital Catapult partnered with Innovate UK's Workforce Foresighting Hub² to establish what future capabilities would be needed in light of the increasing use of real-time rendering engine technology. The team conducted the foresighting cycle with representatives from across education and industry who were interested in the future requirement that this convergence of technology and relevant industries will create. This report acknowledges the impact of new technologies such as machine learning (ML), virtual reality (VR) and augmented reality (AR) on the creative industries. The foresighting cycle was conducted between January and March 2023, with the following challenge:



Utilising real-time rendering engines to drive the acceleration of Advanced Media Production



Key takeaways

- **124** future capabilities have been identified as needed across different functions within the workflow of the future of Advanced Media Production.
 - As the use of real-time rendering engines within Advanced Media Production cannot be isolated, these capabilities are not about the skills needed for these technologies only; the capabilities encompass all the needs of the workflow.
- **Sixteen** potential future occupational profiles have been developed. These are distributed across three role groups (RGs), from production assistant to leadership.
- **Knowledge** of lighting, the use of digital cameras and production, while not surprising, are key areas established as necessary across the whole workflow (in the new occupational profiles). Knowledge of 3D, 3D rendering and CAD were areas that the educators felt would be needed by professionals in all parts of the workflow, not just by specialists.
- Designing graphics, defining technical requirements, understanding and analysing business requirements, logistics and the use of technical drawing software were identified as key **skills** needed in the context of the new occupational profiles.
- Participating educators said the future workforce would need the following top five **behavioural** traits: focus on detail, organisational skills, clear communication, adaptability, and conscientiousness.



- The mapping and gap analysis step, which used a range of existing Institute for Apprenticeships and Technical Education (IfATE)³ standards, highlighted that many of the current apprenticeship standards associated with the creative and media industries lacked competencies identified for the new occupational profiles, signalling the need for deeper analysis of what those gaps mean.

The 16 future occupational profiles show the need to have an element of understanding of this technology across the entire workflow, no matter what level of role group. This understanding could be required in the form of business outcomes through the use of game-engine technology, or more technical through needing knowledge of the 3D rendering and storyboarding in real time. Also important to note is that not everyone needs to be an expert in the technology. The level of skill required can range from an initial awareness all the way to expertise, intimating the importance of knowledge of the technology and its impact on the Advanced Media Production workflow.

What is also clear from the findings in this report is that the increasingly integrated and interdisciplinary nature of the Advanced Media Production workflow and its future capabilities requires a wider conversation on skills development. This conversation will need to include the voices of not only employers and training providers, but all the industries that make up the CreaTech sector. This will give them the opportunity to learn from each other how skills development is happening now and how they can take a more joined-up approach in the future.



2. Thinking about skills in Advanced Media Production

The government and industry stakeholders have identified the creative industries as a driver of economic growth and employment⁴. HM Treasury's Plan for Growth⁵ and the Department for Science, Innovation and Technology (DSIT) and Department for Business, Energy and Industrial Strategy (now Department for Business and Trade) Innovation Strategy⁶ both affirmed that the creative industries are at the forefront of the country's growth sectors for the future economy. Most recently, Lucy Frazer, the culture secretary, emphasised the UK's "tech know-how and production skills" in the screen industries and committed to growing the creative industries by £50bn and creating one million extra jobs for the sector by 2030.⁷

The creative industries contributed £109bn to the UK economy in 2021 – the equivalent of 5.6% of the UK economy in that year, despite the fact that the largest sub-sector was highlighted as IT, software and computer services (2.3% of the UK economy)⁴, signalling the increasing confluence of creative and technology. This confluence, known as CreaTech, brings together creative skills and emerging technologies to create new ways of engaging audiences and to inspire business growth and investment. The value of the UK CreaTech ecosystem has increased by 161% since 2017⁸, and is set to continue this growth with the government's 2030 ambition for the UK to be world leaders in areas including: digital media production, live performance production, sustainable fashion, the application of technology to content creation, distribution,

consumption and discovery, and even the responsible use of AI across the sector especially in new models for advertising and content creation. Given the commitment from the government to support the growth of the creative industries combined with a significant emphasis on digital technologies and infrastructure, it is a crucial time to consider the requirements for the future CreaTech workforce.

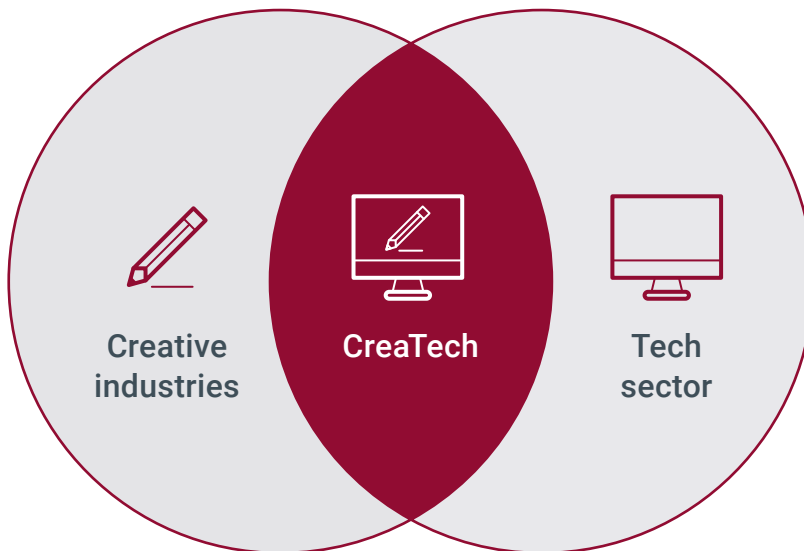


Figure 1: CreaTech is the intersection between creative industries and the tech sector. Source: Tech Nation, 2021⁹

This convergence of technologies across the creative industries has been happening steadily over the past decade. The fundamental enablers of film, TV, theatre and gaming (among others) have been consolidated, converged and commodified into products such as Unreal Engine, Unity, Disguise, Notch and Touch Designer, all of which combine technologies and bring new assets into traditional media production. Advanced Media Production is one such 'new' workflow combination that has emerged from this convergence.

This disruption of traditional production processes and workflows has enabled new ways of working within and across industries, opening up new opportunities for markets, products and services. As such, the requirement for a talent pipeline, and the associated skills and training provision, has grown. This reveals the challenge of making sure the right skills are not only available now but as innovation in this space continues.



Figure 2: An example of the use of VP (LED wall and motion capture cameras with real time rendering technology to create backdrops) on the sets of the TV show The Mandalorian.

Research¹⁰ from the Creative Industries Policy and Evidence Centre has highlighted that the creative sector is dominated by micro-businesses, with over two-thirds of organisations employing between two and four employees, and only a small proportion being medium (4% of the sector) and large (5%). Despite the predominance of micro-businesses, the creative industries and the creative economy are major employers and the equivalent of 6% of the UK workforce is considered to work in this economy whether as employees or self-employed¹⁰.



The conversation about skills needed in the creative, screen and immersive sectors has been building for decades. Given the size of the organisations that dominate the sector, it is important for this conversation to be more joined up, bringing in voices across regions and specialisations. This has been recognised by the screen sector, for example, through the announcement of regional British Film Institute [\(BFI\) Skills Clusters](#) giving a more localised approach to workforce development and making use of its connections to regions and the ability to learn across them.

This report has drawn insights from research across these sectors to understand the skills needs of the screen, media and immersive sectors, and how digitalisation may be affecting these needs now and in future. By no means a comprehensive review, the research highlights the need for a more joined-up conversation on skills across sectors, a mobilisation of all stakeholders across the various industries, a revisiting of apprenticeship and training standards, and the need for better mentoring and reliable careers information. It is important to draw the distinction between the types of skills challenges that employers face⁹:

- **Skills shortages:** A measure of an employer's inability to find skills, qualifications or even experience when trying to recruit for specific roles/vacancies.
- **Skills gaps:** A measure of the gap between the skills of the current workforce and the needs of the current roles that it fills (also can be thought of as a skills mismatch).

At a high level, work in the creative economy has been identified¹⁰ as concentrated in 'higher level occupations', usually involving a high level of qualification (50% at Level 4 and 21% at postgraduate, or Level 5). The three higher level occupations (managers, directors and senior officials; professional occupations; and associate professional and technical occupations) make up 83% of creative industries employment, where only 3% of the employment is in the lower levels of occupational structure (process, plant and machine operatives; and elementary occupations).



Skills requirements across the film industries have been considered a priority area in the creative industries for some time. In 2017, the BFI commissioned the Work Foundation to undertake a skills audit¹¹ for the UK's film and adjacent screen industries and develop strategic objectives to ensure the success of these industries over the next decade. Following a programme of research and consultation, the review identified skills shortages in occupations across the workflow of these industries. This ranged from production accountants to 3D model makers and art directors; and from those working in big data analytics to those required in post-production with VFX skills (effects, rigging, and compositing). This research also highlighted the need for a trusted and reliable careers service, an accreditation system to guarantee employer confidence, and even the need for a skills forecasting service to identify the changing needs of the industries.

The BFI's subsequent Skills Review in 2022¹² highlighted a skills gap that negatively affects productions, leading to increasing levels of stress on sets. The report said the screen sector needed to invest at least 1% of production budgets in training the future workforce – training that is industry-led and localised to meet the needs of specific regions. The BFI also called for a more formalised hiring, workplace management and professional development; stronger bridges into industry from education and other sectors; and more comprehensive careers information, profiles and pathways.

Research funded by the High-end TV Skills Fund sought to identify the key skills and grade shortages as well as any associated issues from the high-end TV industry¹³. Data from this research suggested that in 2022 and 2023 the industry continues to suffer from a very high level of demand and that most of those who took part in the study perceived the skills shortage and skills gap issues as being “very serious” or “serious”. This was particularly acute in the roles



of Post Production Supervisor; Art department non-specific; Assistant Production Accountant; Financial Controller; Director; and even Series Producer. The top five skills found to be lacking in the crew being hired now were leadership, financial acumen, management, resilience and communication. The issue of leadership was found to be complex and multi-faceted, as leadership is not easily taught. Issues relating to management and leadership were identified as a factor of the increasing size of crews and teams, rather than just a lack of experience.

Attention has more recently turned to emerging shortages at the intersection of film and digital skillsets, particularly related to VP methodologies. In 2023, a report by Bennett et al¹⁴ identified “an urgent need to rapidly develop new skills, and grow new talent and capacity in organisations that show potential and appetite to use Virtual Production (VP), in order to meet rising demand.” Using mixed-method approaches, the report (part of the StoryFutures programme activity) highlighted that any training developed would be significantly more valuable when gained while “working within a VP ecosystem”¹⁴ rather than in isolation. It also noted that even though there are a number of new training initiatives available in 2023, the growing demand for the skills needed for VP continues to outstrip the supply of labour.

Highlighting the convergence needed in VP as film and game culture integration, the authors emphasise that this is not easily pinpointed in their VP Skills Mandala (a framework of skills needed for VP as articulated by their research participants). The synchronisation that is required due to the convergence of these sectors indicates the particular need for “soft” or employability skills such as **communication**, to “... help achieve a balanced role between the varied roles”¹⁴ (p. 42) across the workflow.



It is worth noting that the [VP Skills Mandala](#) identifies the skills and roles for which there is the greatest need, in order to address shortages in the labour market. It also highlights the skills gaps in R&D across both creative and communicative and technical and logistical categories. The skills found to be most in need included ones required for roles in Art Departments and Games Engines; Coding and Engineering; Asset building and Optimisation; Management – Senior Team and Business Development and Film-Games Culture Integration, with the role hardest to fill being that of VP supervisors. R&D skills gaps of a technical nature were largest in Coding and Engineering, whereas those of a creative and communicative nature were largest in the Art department and Game Engines.

Our report aims to add to the body of literature by emphasising that VP is a confluence of technologies that are evolving and therefore requires a new framing of occupations and skills needs. There is a need to further explore how the UK's strengths in game development can build bridges into other sectoral strength areas in the creative industries, as the delivery of digital-first experiences is growing. This report is not about articulating the skills shortages or skills gaps of now, but instead looking towards the future in order to understand how workflows, roles and skills needs may change as technology evolves. What follows describes how skills foresighting works.

3. What is 'Workforce Foresighting'?



Skills policy has for too long laboured under the false paradigm that education providers are responsible for providing oven-ready skilled labour to the workplace, that qualifications are a proxy for skills, and that the role of business is to submit timely requisition forms to get employees with the skills they need.

This simplistic yet compelling narrative sets impossible expectations for everyone. Employers can be blamed for not clearly articulating the skills they need in a timely manner, awarding bodies and those responsible for setting standards for failing to properly translate skill needs into standards and qualifications, and 'providers' (a term I find particularly unhelpful) for a failure to follow the 'recipe' given them by the qualifications and/or a failure to deliver the skills needed.



Michael Davis, former head of UKCES, 2015: 67–8¹⁵



The identification and development of skills needs has been the subject of much debate in academia and industry for many years, namely understanding where skills interventions are most timely and effective. Providing the right skills at the right time in the right place is incredibly tricky to achieve, yet this forms the foundation for how impactful innovation can take place.

In 2020, the Gatsby Foundation, in collaboration with the High Value Manufacturing Catapult (HVMC), the Welding Institute and the National Physical Laboratory, published¹⁶ an aligned approach to the development of skills, extending beyond the manufacturing workforce to also consider other sectors and crossover areas.

A major outcome of this report was the development of a skills value chain (SVC) which "... recognises the necessity to link current and future initiatives and activities that individually address a specific need but that collectively generate a strategic and system-level response and outputs."¹⁶ (p. 44).

The concept of the SVC involves triangulating technology, education and employers' groups purposefully to deliver value for all stakeholders involved in a particular sector. It aims to link technology strategy to the requirements of its future workforce, along the way articulating where new standards, qualifications and upskilling courses may be required in the current workforce. As articulated by Rea¹⁷, it comprises three sequential activities:

- Convening centres of innovation, employer and providers to carry out foresighting to establish emerging skills needs in a sector, and analyse the gap between provision and need.
- Developing course content and modular training to meet the need identified in foresighting.
- Delivering skills diffusion by training trainers, delivering funded learner uptake to employees in the sector, and working with high-quality providers to make the courses widely available.

The first step of the SVC is **Workforce Foresighting** (inside red dashed line in Figure 3) which establishes the future competencies needed for industry to adopt and exploit emerging technology capabilities, such as industrial digitisation¹⁸. The process of Workforce Foresighting as defined by the HVMC-led team is the act of determining the skills needs of the future where forecasting is determining the skills needs of now.

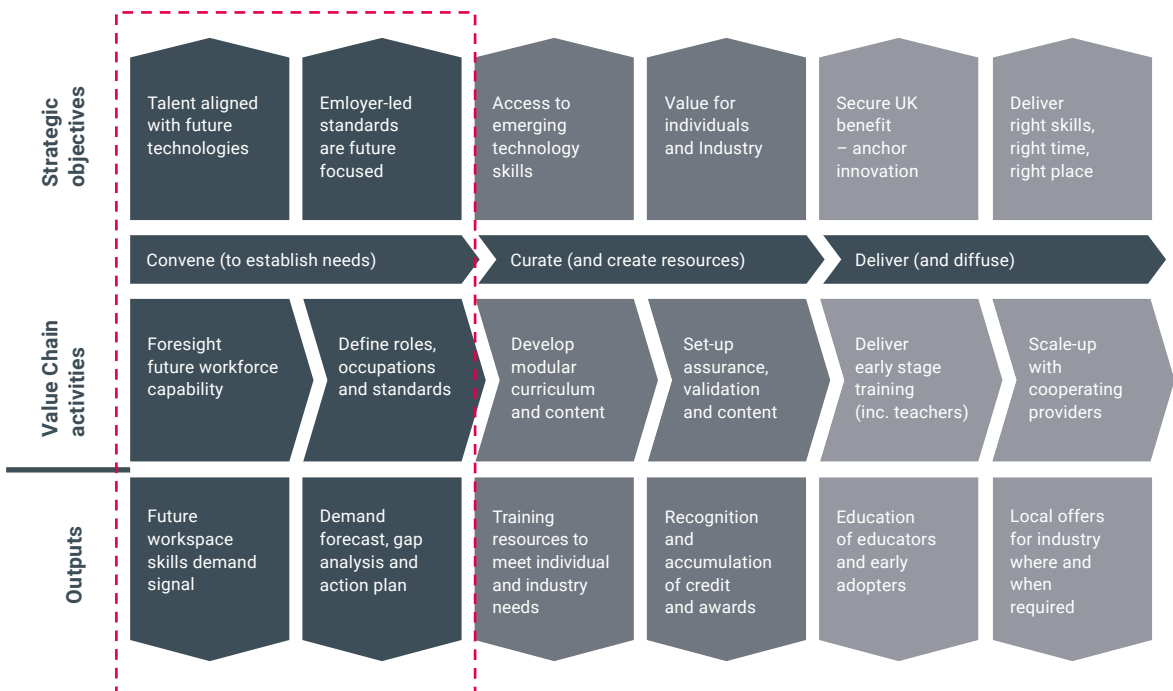


Figure 3: Skills value chain as articulated by the Workforce Foresighting Hub

The process developed, and now deployed, by the Workforce Foresighting Hub¹⁹ uses a framework of structured discussions, workshops, analysis and evaluation to propose changes to standards and qualifications as well as future education and training provision at all levels. Workforce Foresighting is the first step in the SVC. The following steps (Fig 3, curate and deliver) must be completed to develop the future workforce with embedded insights and experience from the foresighting cycle.

Partnering with the Workforce Foresighting Hub, Digital Catapult undertook a foresighting cycle focused on the use of real-time rendering technology to advance the use of Advanced Media Production. With input from technologists, employers and educators, future organisational capabilities have been identified, along with what future occupations in Advanced Media Production could look like. In Section 4, we present a detailed description of the methodology used.





4. Methodology

The Workforce Foresighting Hub has developed a framework of structured discussions, workshops, tools and analysis to identify future skills needs and propose changes to the current training provision. This framework seeks to establish and use a common language, taxonomy and syntax among the key stakeholders to allow for insights to be shared across sectors for mutual benefit and efficiency²⁰. The steps and processes in the foresighting cycle capture the current capabilities in a supply chain (or workflow in the case of Advanced Media Production), as well as current responsibilities (triangulating the knowledge, skills and behaviours for these duties). The Workforce Foresighting Hub team has used definitions and interpretations that allow for linking with larger, more global data sets on skills available from IfATE, National Occupational Standards (NOS), Occupational Information Network (O*NET) and the European Skills, Competences, Qualifications and Occupations (ESCO).

As this process and system is continuously improving, the workshop, tools, surveys and initial analysis for this foresighting exercise were run by the Workforce Foresighting Hub. The Digital Catapult team carried out the challenge identification (alongside Target3D), collation and curation of research participants, interpretation of the data and crafting of the narrative.

The structured approach to the foresighting activity is highlighted in Figure 4 below:

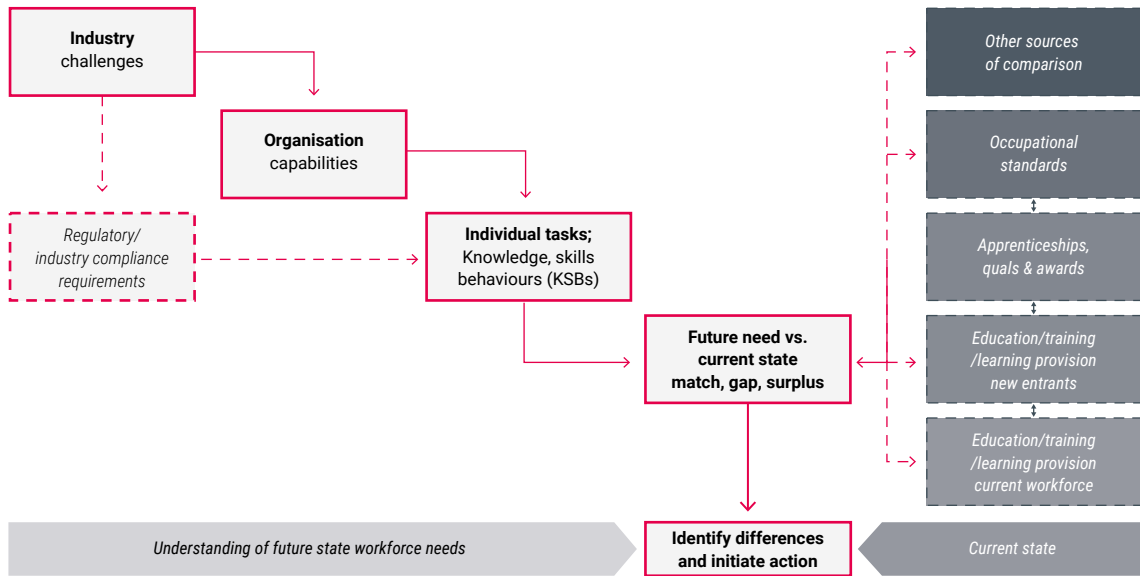


Figure 4: Structured approach to the foresighting process as articulated by the Workforce Foresighting Hub

Foresighting begins with identifying a challenge or an opportunity to take through to establishing the skills needed to address it. Once the opportunity or challenge is identified, the technologies needed to address it are identified, and then the foresighting process determines the organisational capabilities required across the workflow. Foresighting then generates the associated workforce competencies, which are compared with current training provision.

Foresighting cycles are made up of six activities (Activity 0 to Activity 6), all of which involve workshops, surveys and conversations with technologists, employers and educators. This cycle was run between January and March 2023.



The participants were across three groups:

- **Technologists:** centres of innovation, academia, institutes, industry practitioners
- **Employers/Users:** across various sectors that might be involved in Advanced Media Production
- **Educators:** Further education (FE), Higher education (HE), private training providers, technologists, industry

The full list of participating organisations is in Annex 1.

As seen in Figure 4, participants feed into and are responsible for different activities, each of which have specific objectives.

4.1

Definitions for foresighting

The Workforce Foresighting Hub developed some definitions to allow for a common taxonomy to use across foresighting cycles even if they cut across industries and sectors. These are:

- **Industry challenge:** Something that needs to be dealt with.
- **Organisational capabilities:** Something an organisation can do. This refers to the collective abilities and expertise of an organisation to carry out a **function**, because provision and preparation have been made by the organisation. The term 'function' describes the organisational component and the kind of tasks it carries out.



Table 1: The functions across an organisation, and how activities and capabilities relate to them

Function	Capabilities and activities
DESIGN	relating to product, service or solution design
IMPLEMENTATION	relating to producing/making/providing products or services
LOGISTICS	relating to procurement, delivery, material or services necessary for operations
SUPPORT	relating to users, in-service support, repair/maintenance, recycling, end of life disposal
ENTERPRISE	strategic planning, leadership and management, human resources, digital backbone, data systems, integration of relevant statutory/regulatory requirements and compliance

The complete framework classification used by the Workforce Foresighting Hub is in Annex 2, including the domains of activity the above functions sit across.

- **Individual tasks; knowledge, skills, behaviours (KSBs):**
Something people have and can use to carry out tasks that enable capability.

4.2

Step 0: Activity Zero

This was constructed as a way of consulting with industry to agree on the challenges to be addressed through the foresighting cycle. These are intended to be industry challenges and are defined in this process as a recognised technological, market or socio-political threat or opportunity for which there is consensus that workforce action is necessary.

The challenge is intended to require a change in the type of workforce that is available for the whole sector or industry. The expected outcomes of this activity were also to agree and validate the predicted time span for this challenge. The time frame that formed the focus of this research is 18 months to five years (up to March 2028), also known as Horizon 2. As a result of mapping the research activity within Horizon 2, sufficient time was allowed to



enable the undertaking of the subsequent steps so that actions and changes (determined through this process) can be applied. Digital Catapult conducted this activity in partnership with Target3D.

4.3

Step 1: Identifying technological challenges (technologist workshops)

The first phase of this cycle (following Activity 0) was to speak to technologists, and specifically those who are close to the technology solutions. This was achieved through two online workshops and one extensive survey to draw out the organisational capabilities needed. The output of this step is a clear understanding of the capabilities that organisations will need and how they are distributed across the supply chain.

4.4

Step 2: Capability allocation (employer workshops)

The next phase was to speak to employers who are early adopters in the technology area, and gather their input through two online workshops and an extensive survey, in order to understand role group proficiencies and the differing proficiency levels needed for the set of capabilities generated by technologists in step 1.

4.5

Step 3: Knowledge, skills and behaviours/KSBs (educator workshops)

The third group that was invited to participate were the educators from HE, FE and commercial training providers. Their role was to determine the necessary knowledge, skills and behaviours required to equip the workforce to deliver the defined capability set.

This was done through two workshops and a shorter survey than those done by the previous participants.



4.6

Step 4: Map and gap

Ideally at the end of a foresighting cycle, competence statements are linked to an organisational capability requirement that responds to a challenge, giving line of sight from roadmaps to skills actions. This map and gap analysis was conducted by the Workforce Foresighting Hub team and involved working with large data sets obtained from IfATE, NOS, and O*NET and bespoke algorithms developed to exploit large language models.

At the end of the analysis by the Workforce Foresighting Hub, the team from Digital Catapult interpreted the data generated from the foresighting exercise to craft the narrative for the future skill needs in Advanced Media Production. This interpretation and narrative have been shared and sense-checked by the research participants who were available. The next step is a call to action which has been presented in this report.



5. Foresighting for Advanced Media Production

With new opportunities come new challenges. The application of new technologies such as programmatic creation of scenes and content; requirement for high-fidelity assets to run in real time on a single workstation (where previously they may have been rendered over days or weeks); and the integration and use of data informed ML models in live action shoots present substantial gaps in both technical and soft skills. In partnership with Target3D, Digital Catapult identified real-time rendering technologies as being in the most pressing need of future skills requirements and intervention. This is due to its prominent role in the complexity of Advanced Media Production. The challenge for this foresighting cycle was articulated as:

Utilising real-time rendering engines to drive the acceleration of Advanced Media Production

It is important to note that while this foresighting cycle has been framed in the context of using real-time game engines to drive the acceleration of Advanced Media Production, the entire workflow has also had to be considered. This is due to the integrated nature of the technology (both software and hardware) in the entire workflow of a production set. The data that is presented here is therefore an overall picture of the key capabilities that we will need to consider across Advanced Media Production. The focus is on the future capabilities needed to effectively implement real-time game-engine technology in this area specifically.

It was also important to take a holistic approach to this foresighting cycle to determine which parts of the workforce need to have at least a minimum level of understanding of the use of game engine technology in the use of Advanced Media Production. This was not about identifying new roles related solely to game-engine technology, or skill needs just for experts in the technology, but instead was about identifying which future profiles in Advanced Media Production will require what level of understanding of the use of the technology in future workflows.

For the purposes of this foresighting cycle, the following workflow was proposed, identifying the most common partners that one may see within the use of Advanced Media Production. These categories are not static and both will change and blend based on the specific production. They exist merely to allow discussion around different types of organisations and requirements for the future skills needs in this area. These partners are in Figure 5 below.

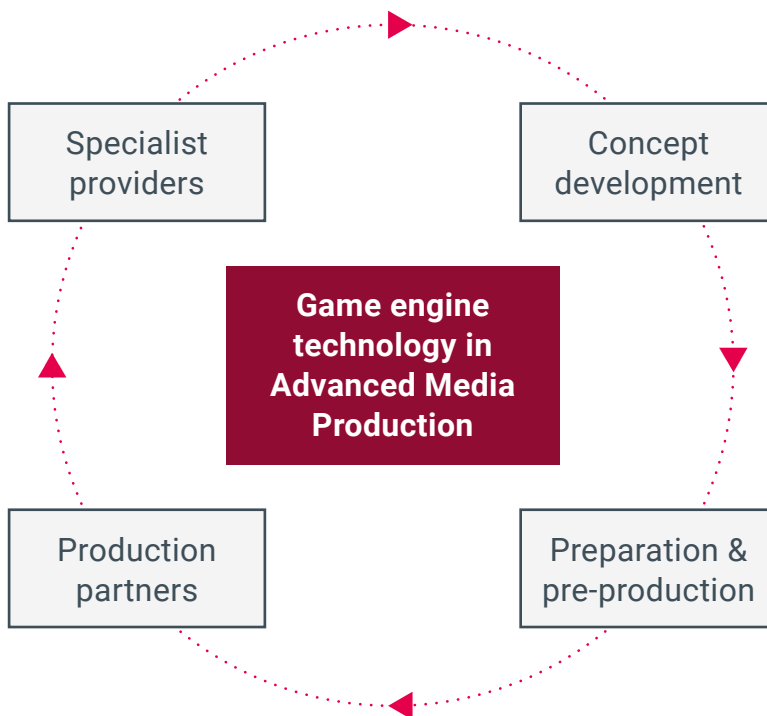


Figure 5: Proposed workflow for the foresighting cycle focused on the use of real-time rendering engines in Advanced Media Production



These partner identities were defined as:

- Partners involved in **concept development**
 - Responsible for conceiving and outlining output to meet the brief/specification defined by the commissioning organisation. Activities include concept generation, storyboard, technical implementation overview, implementation plan and identification of specialist suppliers/partners.
- Partners involved in **preparation & pre-production**
 - Conduct the detailed work/activities required to design and create the necessary elements required such as sets, scenery and props. These partners operate with the use of game-engine technology to replace previous physical /location activities and also to replace traditional scenery/backdrop preparation.
- **Production partners**
 - Responsible for executing production activities – filming /recording of each scene as defined by storyboard/production schedule.
- **Specialist providers**
 - Includes a range of creative and production businesses that provide specialist products and services such as storyboarding, scripting, set design, set production/implementation, lighting, filming/recording, audio, post-production and editing.
 - Also includes technologists such as programmers, those involved in implementation and adaptation of new technologies, and those who create game-engine widgets to include bespoke functionality.



Across the workflow, the teams at Digital Catapult and Target3D articulated RGs and proficiency levels that were validated by the technologists who had participated in the early parts of the foresighting cycle as industry standard. These are:

RG#1: Production assistants – runner, camera, lighting, LED systems

- Junior roles undertaken by new entrants into the industry
- Tasks and activities are well defined and specified by senior roles
- Primarily works within a defined team with clear boundaries and expected outcomes

RG#2: Technical leads and specialists – senior production manager

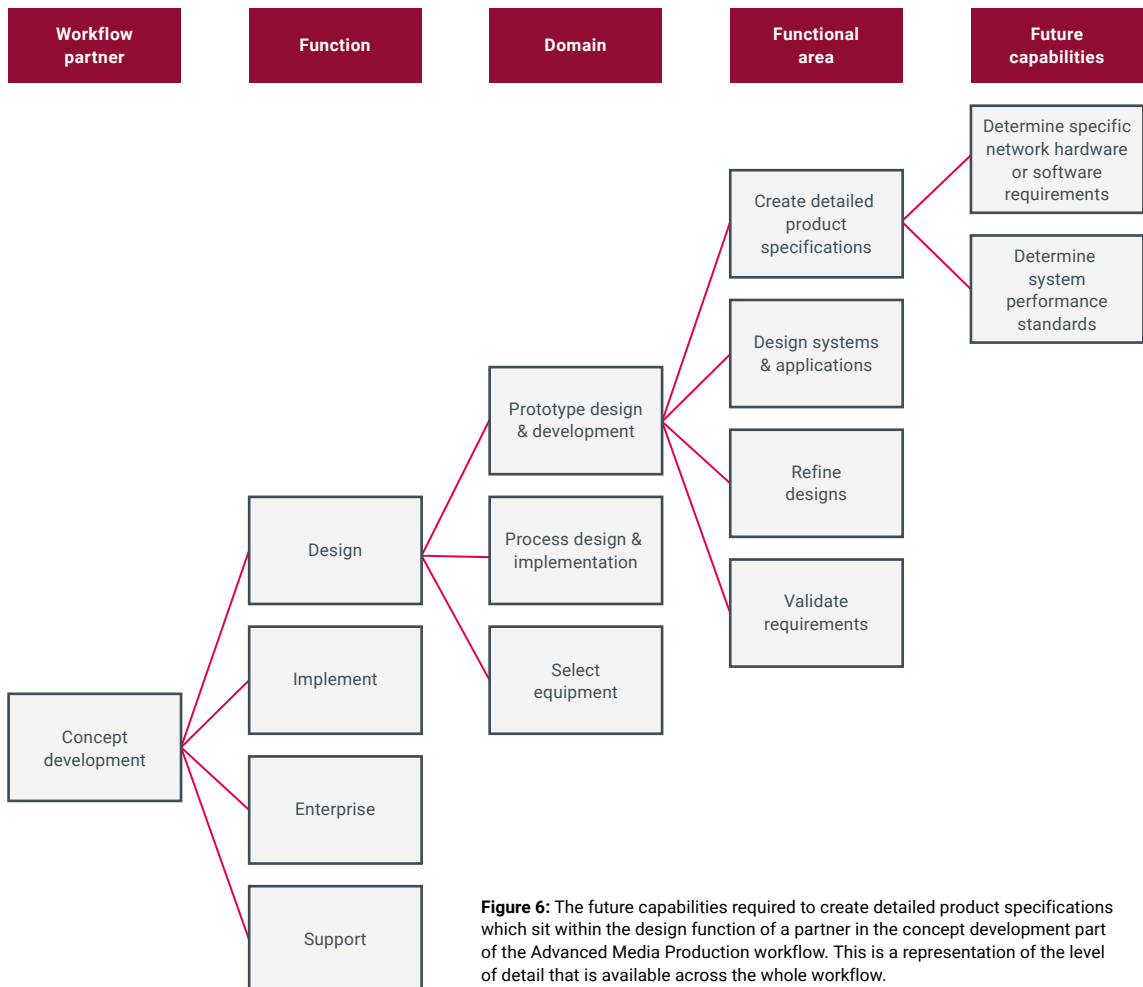
- Specialist roles responsible for providing specific input in the overall production workflow such as lighting/audio/mocap/unreal lead
- May lead a team of related specialists
- Responsible for interpreting creative requirements and providing appropriate solutions reflecting situational constraints – budget, time, resources etc
- Responsible for prioritising and managing own and relevant team activities

RG#3: Departmental head – production, camera, sound, lighting, post-production etc

- Overall technical lead for their discipline
- Responsible for creative/conceptual thinking required to deliver client briefs; sets creative or technical direction for a production
- Liaises with other heads to ensure delivery of work
- Partly or directly responsible for budget relating to their area of expertise

5.1 The future capabilities needed in Advanced Media Production

124 future capabilities were defined across the five functions in the articulated Advanced Media Production workflow. Each of these capability statements is linked to an **organisational capability requirement** which responds to the set challenge. When considering the distribution of these capabilities across the workflow, **25** were found relevant to those involved in concept development; **70** relevant for those involved in preparation and pre-production; **103** relevant to production partners; and **106** relevant to specialist providers. These future capabilities have been classified by function, domain and functional area, as shown in Figure 6:





There are **109** shared future capabilities across the four **workflow partners** in the Advanced Media Production workflow, validating the increasingly integrated nature of the functions and roles across the use of Advanced Media Production (See Annex 3 of this report). That said, there were **15** unique capabilities identified that were not shared across multiple workflow partners, of which those most relevant to the use of real-time rendering technologies in Advanced Media production are in Table 2 below:

Table 2: Examples of capability statements relevant to the use of real time rendering in Advanced Media Production

Workflow partner	Functional area	Capability statement
Concept development	Design and configure support systems	Update 3D or interactive representations of designs using computer-assisted design (CAD) software
Preparation and pre-production	Evaluate product characteristics and quality	Observe sets during rehearsals in order to make sure set elements do not interfere with performance aspects such as cast movement and camera angles
Production partner	Prepare informational or reference materials	Create 2D and 3D images depicting objects in motion or illustrating a process, using computer animation or modelling programmes
Specialist provider	Design data storage	Develop or apply data mining and ML algorithms
Specialist provider	Prepare informational or reference materials	Create 3D or interactive representations of designs, using CAD software.

The full list of the detailed capability statements across the five functions is in Annex 4. All the identified capability statements are not related to real-time engines. This is because this foresighting cycle has been framed in the context of using real-time game engines to drive the acceleration of Advanced Media Production. The entire workflow has also had to be considered. This is due to the integrated nature of the technology (both software and hardware) within the entire workflow of a production set. The data in this report is an overall picture of the key capabilities that will need



to be considered across Advanced Media Production, with a focus on those needed to implement real-time game-engine technology in this area specifically.

5.2 Future occupational profiles to be considered?

Through their workshops, employers were asked to consider the identified future capability statements and relate them to the differing knowledge, skills and behaviours required of each identified **RG**. These were expressed using one-off proficiency levels – awareness, practitioner and expert, defined in a way that would best reflect the reality of the Advanced Media Production workflow. Some may need awareness of some capabilities, and be practitioners in some; and a few may be experts. The levels were defined as follows:

- **Awareness:** These users have an awareness of basic knowledge, terminology, relevance to sector, industry and company and/ or sufficient comprehension to know where to seek more information if necessary to address a specific issue.
- **Practitioner:** These users are able to apply and use a tool, system or process independently. They understand the implications/ consequences/impact for their role/function, know what key actions are required and in what context.
- **Expert:** These are specialised users with detailed knowledge of process, system or tool. Their role requires them to support others and identify improvements required for a process, system or tool and either commission others to implement improvements or could implement improvements personally.

NB. Experts are **not always** the ones that have the highest educational qualifications (Level 6/7 in terms of national qualifications) or the most experience and therefore sit in RG#3. In some cases, experts can sit in RG#1 or RG#2 due to their specialisations.



Using data captured from technologists and employers, the workforce foresighting system generates a set of possible **future occupational profiles (FOPs)** for each RG and each workflow partner.

Sixteen potential FOPs were identified across the three RGs, distributed as shown in Table 3:

Table 3: Distribution of FOPs across the identified workflow

RG	RG name	# of potential FOPs	Place in workflow
#1	Production assistants	3	Production partner, specialist providers, preparation and pre-production
#2	Technical leads and specialists	6	Production partner, specialist providers, preparation and pre-production
#3	Departmental head	7	Production partner, specialist providers, preparation and pre-production, concept development

These 16 FOPs indicate an interdisciplinary and multiskilled profile that will exist across the different levels. This means all future roles will contain elements and requirements of different proficiency levels across the creative, business and technical domains. Indicating the perceived importance of the role of real-time rendering technologies among technologists, employers and educators, capabilities linked to these technologies were found to be required in all parts of the workflow and across the RGs. While not every occupational profile required expert knowledge of the technology, at least an awareness of it was needed across the board.

Capabilities linked to real-time engine technology were found to be needed at different levels across different FOPs, as shown in Table 4 below. These are two of the FOPs at the departmental head (RG#3) levels, which sit at different parts of the workflow.



FOP#13: Departmental head | Concept development

FOP#16: Departmental head | Production partner

Table 4: Example of levels of proficiency for capabilities relevant to different FOPs in RG#3: departmental heads

Function	Required capability	FOP #13	FOP #16
SUPPORT	Undertake development, directing, cinematography and editing to animation to create storyboards that show the flow of the animation and map out key scenes and characters	E	E
SUPPORT	Prepare scale drawings or architectural designs, using CAD or other tools	P	
SUPPORT	Prepare and revise initial game sketches using 2D and 3D graphic design software	E	
SUPPORT	Manage scripting and planning, and create animated narrative sequences against tight deadlines, using computer software and hand-drawing techniques	P	
SUPPORT	Create demonstrator prototypes for presentation to creative and technical staff and management	E	
IMPLEMENT	Participate in multidisciplinary projects in areas such as VR, human-computer interaction, or robotics	E	
IMPLEMENT	Ensure effective communication and collaboration between technical directors, managers, crew members, and writers to discuss and agree details of production, such as photography, script, music, sets and costumes	E	E
IMPLEMENT	Devise and apply processes to ensure integration of plot, score, sound and graphics into a continuous whole, ensuring close coordination of audio, visual, music, optical or special effects departments	E	E
IMPLEMENT	Coordinate the activities of writers, directors, managers and other personnel throughout the production process	E	E
ENTERPRISE	Offer specific training programs to help workers maintain or improve job skills	E	
ENTERPRISE	Obtain rights to scripts or other items such as existing video footage	E	E
ENTERPRISE	Evaluate environmental characteristics, such as venue size and lighting plans, to determine makeup requirements	E	
ENTERPRISE	Estimate set- or exhibit-related costs, including materials, construction and rental of props or locations	E	E



Function	Required capability	FOP #13	FOP #16
ENTERPRISE	Confer with management and conduct surveys to identify training needs based on projected production processes, changes and other factors	E	
DESIGN	Use databases and software applications, such as geographic information systems (GIS) mapping and AI tools	P	
DESIGN	Plan details such as framing, composition, camera movement, sound, and actor movement for each shot or scene	E	
DESIGN	Plan and develop pre-production ideas into outlines, scripts, storyboards, and graphics, using own ideas or specifications of assignments	E	
DESIGN	Identify and approve equipment and elements required for productions, such as scenery, lights, props, costumes, choreography and music	E	
DESIGN	Develop processes to select settings and locations for films, plan, schedule and sequence scenes that will be shot at locations	E	E
DESIGN	Determine system performance standards	E	
DESIGN	Determine specific network hardware or software requirements, such as platforms, interfaces, bandwidths or routine schemas	P	
DESIGN	Create and maintain accessible, retrievable computer archives and databases, incorporating current advances in electronic information storage technology	P	
DESIGN	Analyse user needs and recommend appropriate hardware	E	E

Details of capability assignments across all the RGs are in Annex 5.



5.3 What knowledge, skills and behaviours does the workforce need to enable organisational capability in the future?

As part of the foresighting process, educators, consisting of representatives from HE, FE, private training providers and industry, were invited to participate in two workshops. The purpose of these workshops was to determine what new competencies would be required by individuals to deliver tasks linked to the future capability needs.

Educators were asked to think about the knowledge ‘tags’ or traits they thought were key to the defined FOPs, and the capabilities that would be required. The top five areas identified were: lighting, cameras, cinematography, digital cameras, and media production. When comparing current apprenticeship standards with the needs of the knowledge domains of the FOPs, it became clear that cinematography, media production, film cameras, film production, 3D rendering, special effects, video editing and 3D modelling may all be underserved by otherwise matched IfATE Occupational (Apprenticeship) Standards (see Table 5). Knowledge of 3D, 3D rendering and CAD were felt to be needed by professionals in all parts of the workflow, not just in the domain of the specialists.



Table 5: Knowledge domains important for the FOPs in Advanced Media Production, and how well current IfATE standards would develop these

Cycle tag	Tag frequency in cycle capabilities	Tag frequency in FOP matched IfATE capabilities
Lighting	25	5
Cameras	20	7
Cinematography	17	1
Digital cameras	10	2
Media production	10	
Design	9	30
Production	9	50
Film cameras	7	
Film production	7	
3D	6	7
3D rendering	6	
CAD	6	3
Design principles	6	8
Special effects	6	1
Specifications	6	10
Video	6	3
Management	5	14
Video editing	5	
3D modelling	4	1
Audio mixing	4	3

When thinking about which skills would be the most important in the context of the identified FOPs, the top 10 skills identified by the educators were as follows (Table 6):

**Table 6:** Key skill requirements for FOPs

Skill tag	Tag count across cycle capabilities
Design graphics	16
Define technical requirements	10
Analyse business requirements	9
Manage logistics	7
Use technical drawing software	7
Coordinate events	7
Coordinate operational activities	7
Negotiate logistics services	6
Develop efficiency plans for logistics operations	6
Control production	6

When considering the current workflow of activity, this starts to blend technical and business-related skills across all the capabilities and profiles, rather than leaving it in the domain of one partner.

When asked to consider which behavioural traits (employability skills) would be most important, the top 10 were as follows (Table 7):

Table 7: Key employability skills needed for future occupations in Advanced Media Production

Behavioural trait	Tag count across cycle capabilities
Detail focused	39
Organised	38
Communicative	29
Adaptable	23
Conscientious	21
Creative	19
Logical	18
Collaborative	17
Proactive	15
Independent	11



5.4 Fit versus current provision

The Workforce Foresighting Hub analysed **324** apprenticeship standards (not just those specific to media, production or games), which involved analysis of **1588** IfATE duties to understand how the identified Future Occupational Standards would be best served by existing education and training provision.

The data generated from the map and gap indicates that the majority of future capabilities identified by our workforce foresighting cycle can be matched to existing duties in the existing apprenticeship standards. What is important, however, is that the workforce foresighting cycle has identified a more joined-up way of working, requiring a more interdisciplinary approach to education and training. This is particularly evident when interpreting the data from the map and gap analysis performed between the capabilities required for each FOP versus the existing apprenticeship standards. There is no one apprenticeship that matches exactly the envisioned FOPs, but apprenticeship standards need to be revisited, to amend current ones or build new ones that allow for combinations of capabilities across apprenticeships.

FOP#3: Production assistant as a specialist provider in the Advanced Media Production workflow

For this FOP, most of the apprenticeships' standards compared and analysed would not be suitable candidates for skills development, indicating that it would need the most development. It is important to note that in this graph, there are some apprenticeship standards that are irrelevant, but would have been analysed as part of the database (such as Fisher) and will sit in the upper corner of the left quadrant. More relevant are those such as the candidate deemed a poor candidate for adoption for this FOP, such as production assistant. What this shows is that the apprenticeship standard for production assistant has a 44% fit with the skills needs of this FOP, and therefore work needs to be done to assess what, if anything, needs changing to meet future needs.

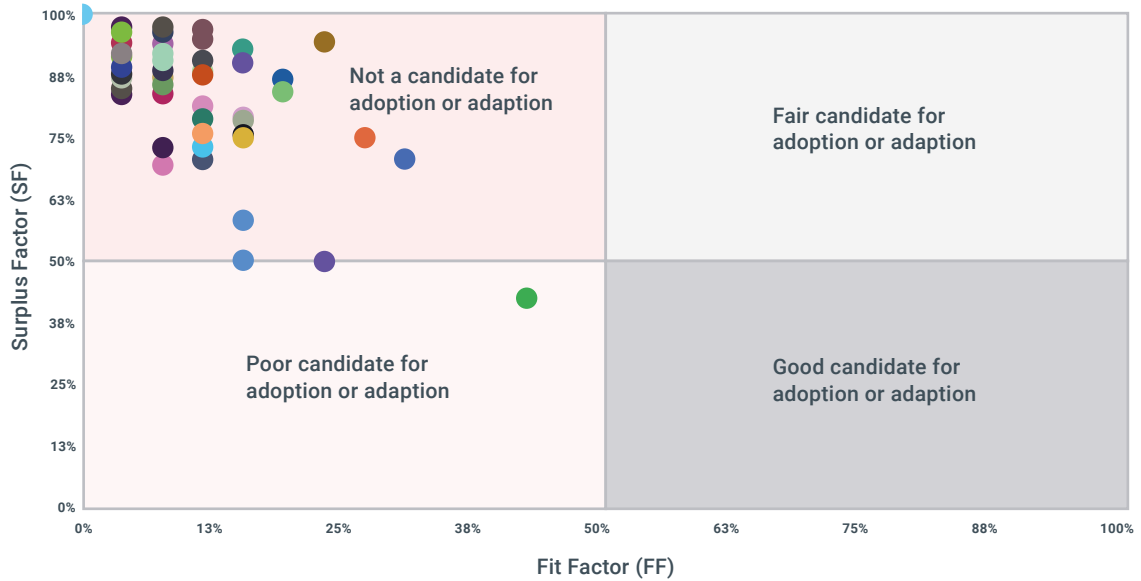


Figure 7: Comparison of capabilities required by a production assistant as a specialist provider in the future as mapped versus current apprenticeship standards.

FOP#10: Departmental head in specialist provider in the Advanced Media Production workflow

The current apprenticeship standard of VFX artist or technical director would be a good candidate for adoption to meet the needs of this FOP. Even with this standard, however, there are some capability statements that can be considered superfluous to the needs, as indicated by the surplus factor of 29% (Figure 8). This indicates that the current apprenticeship standard would need revisiting to assess if the FOP is indeed the one that makes sense for this part of the workflow.

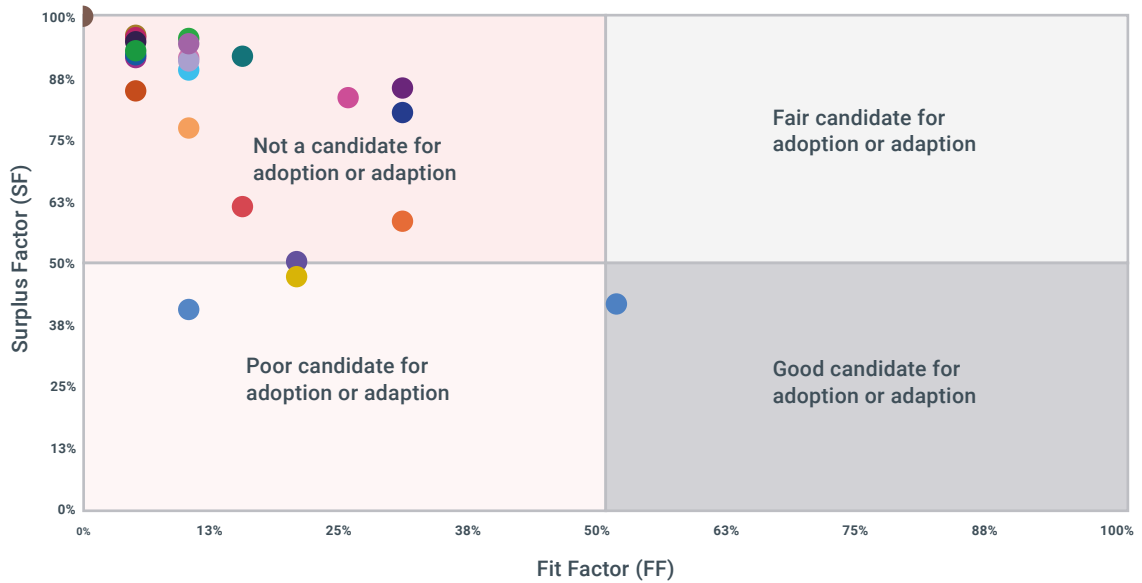


Figure 8: Comparison of capabilities required by a departmental head as a specialist provider in the future as mapped versus current apprenticeship standards.

What the overall analysis indicates is that current apprenticeship provision needs more detailed analysis versus the identified FOPs for Advanced Media Production. The current analysis would indicate that only three apprenticeships standards are fit for purpose for adoption or adaptation as they stand currently, and then sit at the department head and technical lead levels. This needs a deeper dive to understand how the capability statements required in the identified FOPs compare with the candidates that have been identified as 'poor'.



6. Conclusion

Having reviewed the FOPs and the analysis of the comparison between future capability requirements and current provision, it makes sense to return to the challenge framed by Digital Catapult and Target3D at the start of this foresighting cycle.

Utilising real-time rendering engines to drive the acceleration of Advanced Media Production

Identifying the future capabilities needed with the evolution of real-time rendering engines in Advanced Media Production has shown that the capabilities needed in future are similar to those of today, just with adaptation towards more advanced digital technologies. What is important, however, is how the distribution of capabilities sits within the proposed workflow and how that is distributed across what the organisational roles of the future could look like. It is also important that the language of capabilities needed is not unique to Advanced Media Production. The strength of the foresighting process is that it seeks to establish a common framework and taxonomy using language that already exists in apprenticeship and O*NET standards – hopefully indicating the need for similar skills across sectors.



An integration of functions

The 16 FOPs suggest that technologists, employers and educators involved in Advanced Media Production all share the belief that future roles will move in the same direction as its workflow – towards a more integrated model. The profiles indicate a need to think about future roles as more integrated across the different functions of business: design, implementation, support, logistics and enterprise. This means future occupations could require a blend of capabilities or activities rooted not only in technical domains but in business functions as well. This is in line with the increasingly integrated nature of the Advanced Media Production workflow. It reveals the need to understand how all partners in the workflow will function to achieve success.

An understanding of real-time rendering engines across the Advanced Media Production workflow

This foresighting cycle has focused on the importance of real-time rendering technology to drive the future success of Advanced Media Production, strengthening the UK's capabilities in this growing area and making use of existing strength areas, such as in game development and production. The 16 FOPs indicate the need to have an element of understanding of this technology across the entire workflow, no matter what level of RG. This could take the form of business outcomes through using game-engine technology, or technical through knowledge of 3D rendering and storyboarding in real time. Not everyone needs to be an expert in the technology. The level of skill required can range from awareness all the way to expert, intimating the importance of knowledge of the technology and its impact on the Advanced Media Production workflow.



A future workforce with higher skills

It is known that the creative sector workforce tends to have a higher level of skills (qualifications are a proxy for skills here), with a higher percentage of the population in the creative sector possessing a Level 4 qualification or above. As per the findings of the capability requirements and where they sit in terms of the defined RGs, there were more FOPs in the mid-high-level roles, indicating the need for high levels of skills or experience as the technology evolves.

A need to validate suitability of current provision

As discussed in Section 5.4, there is no singular existing apprenticeship standard that matches exactly with the needs of the FOPs. This means there is a need to convene to establish, and embark on, the next part of the SVC. It is necessary to make sure that key stakeholders across industries involved can come together to validate the FOPs and address the suitability of the training provision. This should involve building an understanding of the more informal structures that sit outside formal apprenticeship schemes but which may provide experience and opportunity.

Organisation and communication are key

When considering the employability skills needed to facilitate successful uses of Advanced Media Production, a keen eye for detail and organisation were highlighted as key skills needing development in the future workforce. The VP StoryFutures report also highlighted communication skills as vital for the future success and sustainable growth of Advanced Media Production. This communication is needed both within the various partners across an Advanced Media Production workflow and with outside audiences and businesses that will engage with Advanced Media Production.



6.1 Limitations of this workforce foresighting cycle

The participating bodies that formed the group in this research included academics, technologists and industry employers from the UK, specifically north-east England, south-east England and Northern Ireland due to geographical bases of the Digital Catapult network. This particular study does not include Scotland or Wales, and was more densely populated by participants based in the north-east; this was the only major limitation noted in the study. The average size of companies that participated were in the SME category, with the majority being in the small-medium bracket. Arguably, however, this is indeed representative of the organisations involved in the CreaTech space.

The workforce foresighting cycle captures a snapshot in time, early 2023, and a particular definition of the workflow of Advanced Media Production, and therefore can only offer suggestions or recommendations, not hard and fast rules. Due to the current state of play in Advanced Media Production, the capability will look to significantly grow, with investments such as CoSTAR, and XRtists over the coming years as new use cases emerge and more people adopt associated workflows.

The comparison of skills needed in the future with skills provision now is limited to apprenticeship standards, and does not capture the nuance of short courses, which are often used in this sector. FOPs and gaps in training provision have been suggested but these need further validation with wider industry before they can be taken forward. Therefore, the next stage of the SVC needs to be considered.



7. A call to action

Future foresighting within Advanced Media Production

As discussed, Advanced Media Production represents the confluence of the creative and digital spaces. While being a methodology or technology in itself, it is also made up of a combination of technologies and methodologies. As advanced digital technologies evolve, and organisations innovate, it will be important to continue the foresighting process. One technology in particular that is increasingly integrated in the Advanced Media Production workflow is AI, particularly generative AI. Much as we considered the use of real-time rendering engines as the driver in Advanced Media Production for this foresighting cycle, we must understand how the use of AI will change the nature of jobs in the Advanced Media Production workflow in the future.

Mobilisation of industry and training across the CreaTech sector

It is clear that the increasingly integrated and interdisciplinary nature of the Advanced Media Production workflow and its required future capabilities will require a more joined-up conversation on skills development. This conversation should cut across employers and training providers and all the industries that make up CreaTech. They need to understand from each other how skills are currently developed and how a more joined-up approach might work in the future.

Validation of the future and joining up with other sectors

With the mobilisation of the CreaTech sector comes an obligation to start the next cycle of the SVC, which is to validate the future skills needs and understand the gaps in current provision. Then, new types of courses will need to be curated to help meet the needs of the future workforce. It will also be important to develop knowledge-exchange practices with other sectors that have embarked on similar foresighting.

Acknowledgment

This report was created in collaboration with:

Digital Catapult

Digital Catapult is the UK authority on advanced digital technology. Through collaboration and innovation, we accelerate industry adoption to drive growth and opportunity across the economy.

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Workforce Foresighting Hub

Initiated and funded by Innovate UK and built in collaboration with the UK's Catapult Network, the Workforce Foresighting Hub provides the process, insight and recommendations required to identify and address future skills demands to enable the UK to adopt innovation and succeed in the dynamic global marketplace.

For more information, visit

<https://iuk.ktn-uk.org/programme/workforce-foresighting/>

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Annex 1

List of participating organisations:

Digital Catapult

Sunderland Software City

Target3D

Infinity 27

XR Therapeutics

Annimation

Maadigital

Solve Evolve

Singularity Studio

Taunt Studios

NI Screen

Vantec

Seerbi

Screenskills

Northern Film Studios

Gateshead College

Sunderland University

Newcastle College

Northumbria University

Middlesbrough College



Annex 2

This annex showcases the framework classification used by the Workforce Foresighting Hub to identify capabilities using a common syntax across sectors.

Capability classification: a common vocabulary, rooted in a framework

5 – Functions	27 – Domains	105 – Function areas	18,000 – Capabilities
DESIGN	<ul style="list-style-type: none"> Technical research Prototype design & development Product engineering Process design & implementation System/equipment design & implementation Supply chain design & implementation 	DESIGN activities	Detailed DESIGN capabilities
IMPLEMENTATION	<ul style="list-style-type: none"> Process monitoring Plan operations Manage operations System/equipment operation & monitoring Input processing & preparation Product processing 	IMPLEMENTATION activities	Detailed IMPLEMENTATION capabilities
LOGISTICS	<ul style="list-style-type: none"> Supply chain management Supply chain operations Inventory management Waste management 	LOGISTICS activities	Detailed LOGISTICS capabilities
SUPPORT	<ul style="list-style-type: none"> Operator support System/equipment maintenance Quality control Health, safety & environment Customer support 	SUPPORT activities	Detailed SUPPORT capabilities
ENTERPRISE	<ul style="list-style-type: none"> Leadership & strategy Human resource management Product management Data management Risk management Regulatory compliance 	ENTERPRISE activities	Detailed ENTERPRISE capabilities

Workforce
foresighting cycles



Other



Annex 3

The full list of the **124** future capability statements identified across workflow partners:

Future capabilities

- Use databases and software applications, such as geographic information systems (GIS) mapping and artificial intelligence tools
- Update three-dimensional or interactive representations of designs using computer-assisted design software
- Undertake development, directing, cinematography, and editing to animation to create storyboards that show the flow of the animation and map out key scenes and characters
- Test lighting equipment function and desired lighting effects
- Test equipment performance, focus of lens system, diaphragm alignment, lens mounts, or film transport, using precision gauges
- Test support systems to prepare and alter trace maps, charts, tables, detailed drawings, and three-dimensional optical models of terrain, e.g. using map/satellite data
- Supervise and coordinate the work of camera, lighting, design, and sound crew members
- Supervise and assign duties to workers engaged in technical control and production of radio and/or television programmes
- Specify appropriate operating procedures for cameras, photographic mechanisms, or equipment such as range and view finders, shutters, light meters or lens systems
- Specify and configure power supply equipment and systems according to requirements
- Set up and perform live shots for broadcast
- Set up and operate portable field transmission equipment outside the studio



- Set up and operate computer editing systems, electronic titling systems, video switching equipment and digital video effects units to produce a final product
- Select and configure cameras, lighting, audio and related equipment to ensure correct focus, exposure, lighting and recording
- Schedule use of studio and editing facilities for producers and engineering and maintenance staff
- Schedule or dispatch workers, work crews, equipment, or service vehicles to appropriate locations, according to customer requests, specifications, or needs, using radios or telephones
- Resolve personnel problems that arise during the production process by acting as liaisons between dissenting parties when necessary
- Render sequential drawings that can be turned into animated films or advertisements
- Render drawings, illustrations and sketches of buildings, manufactured products, or models, working from sketches, blueprints, memory, models, or reference materials
- Recommend purchase of equipment to control dust, temperature, or humidity in area of system installation
- Provide technical direction of personnel during filming
- Produce studio sets, select and configure cameras, audio, and lighting equipment to be used during production
- Produce rough and finished graphics and graphic designs
- Produce graphics for broadcasts
- Produce aircraft cameras, still or motion picture cameras, photographic equipment, or frames, using diagrams, blueprints, bench machines, hand tools, or power tools
- Preview scheduled programmes to make sure signals are functioning and programmes are ready for transmission



- Prepare two-dimensional concept layouts or three-dimensional mock-ups
- Prepare scale drawings or architectural designs, using computer-aided design or other tools
- Prepare rough drafts and scale working drawings of sets, including floor plans, scenery, and properties to be constructed
- Prepare preliminary renderings of proposed exhibits, including detailed construction, layout, and material specifications, and diagrams relating to aspects such as special effects or lighting
- Prepare and revise initial game sketches using two- and three-dimensional graphical design software
- Prepare detailed storyboards showing sequence and timing of story development for television production using virtual film and TV production
- Plan for location-specific issues, such as space limitations, traffic flow patterns, and safety concerns
- Plan details such as framing, composition, camera movement, sound and actor movement for each shot or scene
- Plan and develop pre-production ideas into outlines, scripts, storyboards and graphics, using own ideas or specifications of assignments
- Perform administrative duties, such as preparing operational reports, distributing rehearsal call sheets and script copies, and arranging for rehearsal quarters
- Participate in the development or testing of electrical aspects of new green technologies, such as lighting, optical data storage devices, and energy- efficient televisions
- Participate in multidisciplinary projects in areas such as VR, human-computer interaction, or robotics
- Participate in design and production of multimedia campaigns, handling budgeting and scheduling, and assisting with such responsibilities as production coordination, background design, and progress tracking



- Organise and maintain compliance, licence, and warranty information related to audio and video facilities
- Operate systems to integrate multiple video sources using equipment such as switchers, projectors and effects generators
- Operate systems that synchronise and equalise pre-recorded dialogue, music, and sound effects with visual action of motion pictures or television productions, using control consoles
- Operate systems that integrate sources of video input from one camera or studio to another, from film to live programming, or from network to local programming
- Operate manual or automated systems to control lighting throughout productions
- Operate equipment to produce programmes or broadcast live programmes from virtual locations
- Operate cameras in any of several different camera mounts, such as stationary, track-mounted, or crane-mounted
- Operate equipment to demonstrate proper use or to analyse malfunctions using training
- Offer specific training programs to help workers maintain or improve job skills
- Obtain rights to scripts or to such items as existing video footage
- Obtain and evaluate information on factors such as reporting formats required, costs, or security needs to determine hardware configuration
- Obtain and assemble data to complete architectural designs, visiting job sites to compile measurements as necessary
- Observe sets or locations for potential problems and to determine filming and lighting requirements
- Observe sets during rehearsals in order to make sure set elements do not interfere with performance aspects such as cast movement and camera angles



- Observe pictures through monitors and direct camera and video staff concerning shading and composition
- Monitor personnel or equipment locations and utilisation to coordinate service and schedules
- Monitor broadcasts to make sure programmes conform to station or network policies and regulations
- Manipulate rigging lines, hoists, and pulling gear to move or support materials, such as heavy equipment, ships, or theatrical sets
- Manage scripting and planning, and create animated narrative sequences against tight deadlines, using computer software and hand-drawing techniques
- Manage procurement and curation of set props, such as furniture, pictures, lamps, and rugs
- Manage makeup sheets and take photos to document specific looks and the products used to achieve the looks
- Manage equipment and make sure timely repairs are made, including emergency repairs when necessary and possible
- Manage camera operators including camera setups, angles, distances, movement, and variables and cues for starting and stopping filming
- Manage accurate and reliable labelling and recording of exposed film or digital media
- Manage cameras, optical printers, and related equipment to produce photographs and special effects
- Make objects or characters appear lifelike by manipulating light, colour, texture, shadow, and transparency, or manipulating static images to give the illusion of motion
- Maintain inventories of audio and videotapes and related supplies
- Interact with teams and crew members responsible for lighting, costumes, makeup, and props



- Install electrical assemblies and wiring in aircraft camera using appropriate tools
- Inspect installed exhibits for conformance to specifications and satisfactory operation of special-effects components
- Identify and approve equipment and elements required for productions, such as scenery, lights, props, costumes, choreography and music
- Evaluate environmental characteristics, such as venue size and lighting plans, to determine makeup requirements
- Estimate set or exhibit-related costs, including materials, construction, and rental of props or locations
- Establish pace of programmes and sequences of scenes according to time requirements and cast and set accessibility
- Ensure robust and reliable signal routing to mitigate against breaks in feeds/inputs
- Ensure effective communication and collaboration between technical directors, managers, crew members, and writers to discuss and agree details of production, such as photography, script, music, sets, and costumes
- Ensure correct use of zoom lenses, changing images according to specifications and rehearsal instructions
- Ensure correct operation of television or motion picture cameras to record scenes for broadcasts, advertising, or motion pictures
- Ensure correct operation of lighting systems in order to meet lighting design plans
- Ensure communication and collaboration between those in charge of lighting and sound so that those production aspects can be coordinated with set designs or exhibit layouts
- Ensure accurate and reliable preparation of slates (clapperboards) that describe the scenes being filmed
- Ensure accurate and reliable preparation of key numbers and time codes on materials



- Ensure the seamless integration of various programming feeds for both receiving and transmission
- Discuss production requirements with clients
- Direct and coordinate activities of assistants and other personnel during production
- Devise and apply processes to ensure integration of plot, score, sound, and graphics into a continuous whole, ensuring close coordination of audio, visual, music, optical, or special effects departments
- Devise and apply processes that enable lighting director or production staff to determine lighting requirements
- Devise and apply processes that enable filter options, lens choices, and the visual effects of objects being filmed to be defined by photography directors and video operators
- Develop processes to select settings and locations for films, and plan, schedule and sequence scenes that will be shot at locations
- Develop processes to determine desired images and picture composition, selecting and adjusting subjects, equipment, and lighting to achieve desired effects
- Develop processes to coordinate technical aspects of light, lenses, film, filters, and camera settings to achieve the effects sought by directors
- Develop processes to compute and specify variables such as lighting, shutter angles, filter factors, and camera distances
- Develop post-production workflows for film using structured methods
- Develop or apply data mining and machine learning algorithms
- Develop computer information resources, providing for data security and control, strategic computing, and disaster recovery
- Develop and deploy models to simulate the behaviour of animated objects in the finished sequence



- Determine system performance standards
- Determine specific network hardware or software requirements, such as platforms, interfaces, bandwidths, or routine schemas
- Design layouts of audio and video equipment and perform upgrades and maintenance
- Design complex graphics and animation, using independent judgement, creativity, and computer equipment
- Design scale models of set designs, or miniature sets used in filming backgrounds or special effects using 3D technologies
- Design graphics for studio productions
- Design computerised graphic effects using Visual Effects Software
- Deploy 3D or 4D technologies to geospatial data to allow for new or different analyses or applications
- Define guidance and working practices to maintain makeup during productions as necessary to compensate for lighting changes or to achieve continuity of effect
- Create 2D and 3D images depicting objects in motion or illustrating a process, using computer animation or modelling programmes
- Create 3D or interactive representations of designs, using CAD software
- Create special effects such as vignettes, mosaics, and image combining, and add elements such as sound and animation to electronic publications
- Create guidelines and templates for video transitions and special effects, such as fades, dissolves, cuts, keys, and supers
- Create demonstrator prototypes for presentation to creative and technical staff and management
- Create and maintain accessible, retrievable computer archives and databases, incorporating current advances in electronic information storage technology



- Create and install special effects as required by the script, mixing chemicals and fabricating needed parts from wood, metal, plaster and clay
- Coordinate the activities of writers, directors, managers and other personnel throughout the production process
- Convert real objects to animated objects through modelling, using techniques such as optical scanning
- Construct and position properties, sets, lighting equipment, and other equipment
- Configure equipment, apertures, shutter speeds, and camera focus according to a combination of factors, such as lighting, field depth, subject motion, film type, and film speed
- Configure and operate audio recording systems
- Confer with management and conduct surveys to identify training needs based on projected production processes, changes, and other factors
- Compress, digitise, duplicate, and store audio and video data
- Calibrate and verify accuracy of light meters, shutter diaphragm operation, or lens carriers, using timing instruments
- Assimilate all relevant aspects of formal game design using mock-up screen shots, sample menu layouts, gameplay flow charts and other relevant methods
- Assemble devices or equipment to be used in green technology applications, including solar energy, high efficiency solid state lighting, energy management, smart buildings, or green processes
- Analyse user needs and recommend appropriate hardware
- Analyse and maintain data logs for audio-visual activities
- Act as liaisons between engineering and production departments



Annex 4

RG#1

Function	Capability
DESIGN	Configure equipment, apertures, shutter speeds and camera focus according to a combination of factors, such as lighting, field depth, subject motion, film type and film speed
DESIGN	Construct and position properties, sets, lighting equipment and other equipment
DESIGN	Select and configure cameras, lighting, audio and related equipment to ensure correct focus, exposure, lighting and recording
DESIGN	Determine specific network hardware or software requirements, such as platforms, interfaces, bandwidths or routine schemas
DESIGN	Produce rough and finished graphics and graphic designs
DESIGN	Create and install special effects as required by the script, mixing chemicals and fabricating needed parts from wood, metal, plaster and clay
DESIGN	Create and maintain accessible, retrievable computer archives and databases, incorporating current advances in electronic information storage technology
DESIGN	Develop processes to compute and specify variables such as lighting, shutter angles, filter factors and camera distances
DESIGN	Devise and apply processes that enable filter options, lens choices, and the visual effects of objects being filmed to be defined by photography directors and video operators
DESIGN	Observe pictures through monitors and direct camera and video staff concerning shading and composition
DESIGN	Plan details such as framing, composition, camera movement, sound and actor movement for each shot or scene
DESIGN	Prepare preliminary renderings of proposed exhibits, including detailed construction, layout, and material specifications, and diagrams relating to aspects such as special effects or lighting
DESIGN	Produce aircraft cameras, still or motion picture cameras, photographic equipment or frames, using diagrams, blueprints, bench machines, hand tools or power tools
DESIGN	Identify and approve equipment and elements required for productions, such as scenery, lights, props, costumes, choreography and music
DESIGN	Manage procurement and curation of set props, such as furniture, pictures, lamps and rugs
DESIGN	Test equipment performance, focus of lens system, diaphragm alignment, lens mounts or film transport, using precision gauges



Function	Capability
DESIGN	Test lighting equipment function and desired lighting effects
DESIGN	Obtain and evaluate information on factors such as reporting formats required, costs or security needs to determine hardware configuration
ENTERPRISE	Evaluate environmental characteristics, such as venue size and lighting plans, to determine makeup requirements
ENTERPRISE	Ensure accurate and reliable preparation of key numbers and time codes on materials
ENTERPRISE	Specify and configure power supply equipment and systems according to requirements
IMPLEMENT	Manage makeup sheets and take photos to document specific looks and the products used to achieve the looks
IMPLEMENT	Act as liaison between engineering and production departments
IMPLEMENT	Perform administrative duties, such as preparing operational reports, distributing rehearsal call sheets and script copies, and arranging for rehearsal quarters
IMPLEMENT	Schedule use of studio and editing facilities for producers and engineering and maintenance staff
IMPLEMENT	Supervise and assign duties to workers engaged in technical control and production of radio and/or television programmes
IMPLEMENT	Obtain and assemble data to complete architectural designs, visiting job sites to compile measurements as necessary
IMPLEMENT	Ensure accurate and reliable preparation of slates (clapperboards) that describe the scenes being filmed
IMPLEMENT	Manage accurate and reliable labelling and recording of exposed film or digital media
IMPLEMENT	Monitor broadcasts to make sure programmes conform to station or network policies and regulations
IMPLEMENT	Preview scheduled programmes to make sure signals are functioning and programmes are ready for transmission
IMPLEMENT	Analyse and maintain data logs for audio-visual activities
IMPLEMENT	Compress, digitise, duplicate and store audio and video data
IMPLEMENT	Manage equipment and make sure timely repairs are made, including emergency repairs when necessary and possible
IMPLEMENT	Monitor personnel or equipment locations and utilisation to coordinate service and schedules
IMPLEMENT	Organise and maintain compliance, licence and warranty information related to audio and video facilities
IMPLEMENT	Create special effects such as vignettes, mosaics and image combining, and add elements such as sound and animation to electronic publications



Function	Capability
IMPLEMENT	Ensure robust and reliable signal routing to mitigate against breaks in feeds/inputs
IMPLEMENT	Manipulate rigging lines, hoists and pulling gear to move or support materials, such as heavy equipment, ships or theatrical sets
IMPLEMENT	Operate cameras in any of several different camera mounts, such as stationary, track-mounted or crane-mounted
IMPLEMENT	Operate equipment to produce programmes or broadcast live programmes from virtual locations
IMPLEMENT	Operate manual or automated systems to control lighting throughout productions
IMPLEMENT	Operate systems to integrate multiple video sources using equipment such as switchers, projectors and effects generators
IMPLEMENT	Set up and operate computer editing systems, electronic titling systems, video switching equipment and digital video effects units to produce a final product
IMPLEMENT	Set up and operate portable field transmission equipment outside the studio
IMPLEMENT	Set up and perform live shots for broadcast
IMPLEMENT	Specify appropriate operating procedures for cameras, photographic mechanisms or equipment such as range and view finders, shutters, light meters or lens systems
IMPLEMENT	Schedule or dispatch workers, work crews, equipment or service vehicles to appropriate locations, according to customer requests, specifications or needs, using radios or telephones
LOGISTICS	Maintain inventories of audio and videotapes and related supplies
SUPPORT	Participate in the development or testing of electrical aspects of new green technologies, such as lighting, optical data storage devices and energy-efficient televisions
SUPPORT	Prepare detailed storyboards showing sequence and timing of story development for television production using virtual film and TV production
SUPPORT	Observe sets during rehearsals in order to make sure set elements do not interfere with performance aspects such as cast movement and camera angles
SUPPORT	Observe sets or locations for potential problems and to determine filming and lighting requirements
SUPPORT	Design layouts of audio and video equipment and perform upgrades and maintenance
SUPPORT	Create guidelines and templates for video transitions and special effects, such as fades, dissolves, cuts, keys and supers
SUPPORT	Create 2D and 3D images depicting objects in motion or illustrating a process, using computer animation or modelling programmes



Function	Capability
SUPPORT	Design computerised graphic effects using VFX software
SUPPORT	Design graphics for studio productions
SUPPORT	Prepare and revise initial game sketches using 2D and 3D graphic design software
SUPPORT	Prepare 2D concept layouts or 3D mockups
SUPPORT	Interact with teams and crew members responsible for lighting, costumes, makeup and props

RG#3

Function	Capability
DESIGN	Configure equipment, apertures, shutter speeds and camera focus according to a combination of factors, such as lighting, field depth, subject motion, film type and film speed
DESIGN	Construct and position properties, sets, lighting equipment and other equipment
DESIGN	Select and configure cameras, lighting, audio and related equipment to ensure correct focus, exposure, lighting and recording
DESIGN	Determine specific network hardware or software requirements, such as platforms, interfaces, bandwidths or routine schemas
DESIGN	Determine system performance standards
DESIGN	Prepare rough drafts and scale working drawings of sets, including floor plans, scenery and properties to be constructed
DESIGN	Produce rough and finished graphics and graphic designs
DESIGN	Render drawings, illustrations and sketches of buildings, manufactured products or models, working from sketches, blueprints, memory, models or reference materials
DESIGN	Create and install special effects as required by the script, mixing chemicals and fabricating needed parts from wood, metal, plaster and clay
DESIGN	Assimilate all relevant aspects of formal game design using mock-up screen shots, sample menu layouts, gameplay flow charts and other relevant methods
DESIGN	Create and maintain accessible, retrievable computer archives and databases, incorporating current advances in electronic information storage technology
DESIGN	Develop computer information resources, providing for data security and control, strategic computing and disaster recovery
DESIGN	Develop post-production workflows for film using structured methods
DESIGN	Recommend purchase of equipment to control dust, temperature or humidity in area of system installation



Function	Capability
DESIGN	Use databases and software applications, such as GIS mapping and AI tools
DESIGN	Define guidance and working practices to maintain makeup during productions as necessary to compensate for lighting changes or to achieve continuity of effect
DESIGN	Develop processes to compute and specify variables such as lighting, shutter angles, filter factors and camera distances
DESIGN	Develop processes to coordinate technical aspects of light, lenses, film, filters and camera settings to achieve the effects sought by directors
DESIGN	Develop processes to determine desired images and picture composition, selecting and adjusting subjects, equipment and lighting to achieve desired effects
DESIGN	Develop processes to select settings and locations for films, and plan, schedule and sequence scenes that will be shot at locations
DESIGN	Devise and apply processes that enable filter options, lens choices and the visual effects of objects being filmed to be defined by photography directors and video operators
DESIGN	Devise and apply processes that enable lighting director or production staff to determine lighting requirements
DESIGN	Establish pace of programmes and sequences of scenes according to time requirements and cast and set accessibility
DESIGN	Observe pictures through monitors and direct camera and video staff concerning shading and composition
DESIGN	Plan details such as framing, composition, camera movement, sound and actor movement for each shot or scene
DESIGN	Prepare preliminary renderings of proposed exhibits, including detailed construction, layout and material specifications, and diagrams relating to aspects such as special effects or lighting
DESIGN	Assemble devices or equipment to be used in green technology applications, including solar energy, high efficiency solid state lighting, energy management, smart buildings or green processes
DESIGN	Install electrical assemblies and wiring in aircraft camera using appropriate tools
DESIGN	Produce aircraft cameras, still or motion picture cameras, photographic equipment or frames, using diagrams, blueprints, bench machines, hand tools or power tools
DESIGN	Plan and develop pre-production ideas into outlines, scripts, story boards and graphics, using own ideas or specifications of assignments
DESIGN	Identify and approve equipment and elements required for productions, such as scenery, lights, props, costumes, choreography and music.
DESIGN	Manage procurement and curation of set props, such as furniture, pictures, lamps and rugs
DESIGN	Produce studio sets, select and configure cameras, audio and lighting equipment to be used during production



Function	Capability
DESIGN	Test equipment performance, focus of lens system, diaphragm alignment, lens mounts or film transport, using precision gauges
DESIGN	Test lighting equipment function and desired lighting effects
DESIGN	Analyse user needs and recommend appropriate hardware
DESIGN	Obtain and evaluate information on factors such as reporting formats required, costs or security needs to determine hardware configuration
ENTERPRISE	Confer with management and conduct surveys to identify training needs based on projected production processes, changes and other factors
ENTERPRISE	Obtain rights to scripts or other items such as existing video footage
ENTERPRISE	Offer specific training programmes to help workers maintain or improve skills
ENTERPRISE	Develop or apply data mining and ML algorithms
ENTERPRISE	Discuss production requirements with clients
ENTERPRISE	Evaluate environmental characteristics, such as venue size and lighting plans, to determine makeup requirements
ENTERPRISE	Ensure accurate and reliable preparation of key numbers and time codes on materials
ENTERPRISE	Estimate set- or exhibit-related costs, including materials, construction and rental of props or locations
ENTERPRISE	Specify and configure power supply equipment and systems according to requirements
IMPLEMENT	Participate in multidisciplinary projects in areas such as VR, human-computer interaction or robotics
IMPLEMENT	Manage makeup sheets and take photos to document specific looks and the products used to achieve the looks
IMPLEMENT	Act as liaison between engineering and production departments
IMPLEMENT	Direct and coordinate activities of assistants and other personnel during production
IMPLEMENT	Manage camera operators including camera setups, angles, distances, movement, and variables and cues for starting and stopping filming
IMPLEMENT	Participate in design and production of multimedia campaigns, handling budgeting and scheduling, and assisting with such responsibilities as production coordination, background design and progress tracking
IMPLEMENT	Perform administrative duties, such as preparing operational reports, distributing rehearsal call sheets and script copies, and arranging for rehearsal quarters
IMPLEMENT	Plan for location-specific issues, such as space limitations, traffic flow patterns and safety concerns
IMPLEMENT	Schedule use of studio and editing facilities for producers and engineering and maintenance staff



Function	Capability
IMPLEMENT	Supervise and assign duties to workers engaged in technical control and production of radio and/or television programmes
IMPLEMENT	Supervise and coordinate the work of camera, lighting, design and sound crew members
IMPLEMENT	Obtain and assemble data to complete architectural designs, visiting job sites to compile measurements as necessary
IMPLEMENT	Ensure accurate and reliable preparation of slates (clapperboards) that describe the scenes being filmed
IMPLEMENT	Monitor broadcasts to make sure programmes conform to station or network policies and regulations
IMPLEMENT	Preview scheduled programmes to make sure signals are functioning and programmes are ready for transmission
IMPLEMENT	Analyse and maintain data logs for audio-visual activities
IMPLEMENT	Compress, digitise, duplicate and store audio and video data
IMPLEMENT	Manage equipment and make sure timely repairs are made, including emergency repairs when necessary and possible
IMPLEMENT	Monitor personnel or equipment locations and utilisation to coordinate service and schedules
IMPLEMENT	Organise and maintain compliance, licence and warranty information related to audio and video facilities
IMPLEMENT	Calibrate and verify accuracy of light meters, shutter diaphragm operation or lens carriers, using timing instruments
IMPLEMENT	Convert real objects to animated objects through modelling, using techniques such as optical scanning
IMPLEMENT	Create special effects such as vignettes, mosaics and image combining, and add elements such as sound and animation to electronic publications
IMPLEMENT	Ensure the seamless integration of various programming feeds for both receiving and transmission
IMPLEMENT	Ensure correct operation of lighting systems in order to meet lighting design plans
IMPLEMENT	Ensure correct use of zoom lenses, changing images according to specifications and rehearsal instructions
IMPLEMENT	Ensure robust and reliable signal routing to mitigate against breaks in feeds/inputs
IMPLEMENT	Manipulate rigging lines, hoists and pulling gear to move or support materials, such as heavy equipment, ships or theatrical sets
IMPLEMENT	Operate cameras in any of several different camera mounts, such as stationary, track-mounted or crane-mounted
IMPLEMENT	Operate equipment to produce programmes or broadcast live programmes from virtual locations



Function	Capability
IMPLEMENT	Operate manual or automated systems to control lighting throughout productions
IMPLEMENT	Operate systems that synchronise and equalise pre-recorded dialogue, music and sound effects with visual action of motion pictures or television productions, using control consoles
IMPLEMENT	Operate systems to integrate multiple video sources using equipment such as switchers, projectors and effects generators
IMPLEMENT	Set up and operate computer editing systems, electronic titling systems, video switching equipment and digital video effects units to produce a final product
IMPLEMENT	Set up and operate portable field transmission equipment outside the studio
IMPLEMENT	Set up and perform live shots for broadcast
IMPLEMENT	Specify appropriate operating procedures for cameras, photographic mechanisms or equipment such as range and view finders, shutters, light meters or lens systems
IMPLEMENT	Devise and apply processes to ensure integration of plot, score, sound and graphics into a continuous whole, ensuring close coordination of audio, visual, music, optical or special effects departments
IMPLEMENT	Ensure communication and collaboration between those in charge of lighting and sound so that those production aspects can be coordinated with set designs or exhibit layouts
IMPLEMENT	Ensure effective communication and collaboration between technical directors, managers, crew members and writers to discuss and agree details of production, such as photography, script, music, sets and costumes
IMPLEMENT	Schedule or dispatch workers, work crews, equipment or service vehicles to appropriate locations, according to customer requests, specifications or needs, using radios or telephones
LOGISTICS	Maintain inventories of audio and videotapes and related supplies
SUPPORT	Create 3D or interactive representations of designs, using CAD software
SUPPORT	Design scale models of set designs, or miniature sets used in filming backgrounds or special effects using 3D technologies
SUPPORT	Participate in the development or testing of electrical aspects of new green technologies, such as lighting, optical data storage devices and energy-efficient televisions
SUPPORT	Prepare detailed storyboards showing sequence and timing of story development for television production using virtual film and TV production
SUPPORT	Prepare scale drawings or architectural designs, using CAD or other tools
SUPPORT	Test support systems to prepare and alter trace maps, charts, tables, detailed drawings and 3D optical models of terrain, e.g. using map/satellite data
SUPPORT	Undertake development, directing, cinematography, and editing to animation to create storyboards that show the flow of the animation and map out key scenes and characters



Function	Capability
SUPPORT	Update 3D or interactive representations of designs using CAD software
SUPPORT	Inspect installed exhibits for conformance to specifications and satisfactory operation of special-effects components
SUPPORT	Observe sets during rehearsals in order to make sure set elements do not interfere with performance aspects such as cast movement and camera angles
SUPPORT	Observe sets or locations for potential problems and to determine filming and lighting requirements
SUPPORT	Design layouts of audio and video equipment and perform upgrades and maintenance
SUPPORT	Create demonstrator prototypes for presentation to creative and technical staff and management
SUPPORT	Create guidelines and templates for video transitions and special effects, such as fades, dissolves, cuts, keys and supers
SUPPORT	Create 2D and 3D images depicting objects in motion or illustrating a process, using computer animation or modelling programmes
SUPPORT	Deploy 3D or 4D technologies to geospatial data to allow for new or different analyses or applications
SUPPORT	Design computerised graphic effects using VFX software
SUPPORT	Design graphics for studio productions
SUPPORT	Design complex graphics and animation, using independent judgment, creativity and computer equipment
SUPPORT	Develop and deploy models to simulate the behaviour of animated objects in the finished sequence
SUPPORT	Make objects or characters appear lifelike by manipulating light, colour, texture, shadow and transparency, or manipulating static images to give the illusion of motion
SUPPORT	Manage scripting and planning, and create animated narrative sequences against tight deadlines, using computer software and hand-drawing techniques
SUPPORT	Prepare and revise initial game sketches using 2D and 3D graphic design software
SUPPORT	Prepare 2D concept layouts or 3D mockups
SUPPORT	Produce graphics for broadcasts
SUPPORT	Render sequential drawings that can be turned into animated films or advertisements
SUPPORT	Interact with teams and crew members responsible for lighting, costumes, makeup and props
SUPPORT	Operate equipment to demonstrate proper use or to analyse malfunctions using training



Annex 5

RG#1

Function	Required capability	FOP#1	FOP#2	FOP#3
SUPPORT	Prepare 2D concept layouts or 3D mockups	P		
SUPPORT	Prepare and revise initial game sketches using 2D and 3D graphic design software	P		
SUPPORT	Prepare detailed storyboards showing sequence and timing of story development for television production using virtual film and TV production	P		
SUPPORT	Participate in the development or testing of electrical aspects of new green technologies, such as lighting, optical data storage devices and energy-efficient televisions		P	
SUPPORT	Observe sets or locations for potential problems and to determine filming and lighting requirements			E
SUPPORT	Observe sets during rehearsals in order to make sure set elements do not interfere with performance aspects such as cast movement and camera angles			E
SUPPORT	Interact with teams and crew members responsible for lighting, costumes makeup and props		P	
SUPPORT	Design layouts of audio and video equipment and perform upgrades and maintenance	E		E
SUPPORT	Design graphics for studio productions	P		
SUPPORT	Design computerised graphic effects using VFX software		P	P
SUPPORT	Create 2D and 3D images depicting objects in motion or illustrating a process, using computer animation or modelling programmes	E		E
SUPPORT	Create guidelines and templates for video transitions and special effects, such as fades, dissolves, cuts, keys and supers			P
LOGISTICS	Maintain inventories of audio and videotapes and related supplies			E
IMPLEMENT	Supervise and assign duties to workers engaged in technical control and production of radio and/or television programmes		P	P



Function	Required capability	FOP#1	FOP#2	FOP#3
IMPLEMENT	Specify appropriate operating procedures for cameras, photographic mechanisms or equipment such as range and view finders, shutters, light meters or lens systems		P	
IMPLEMENT	Set up and perform live shots for broadcast		P	
IMPLEMENT	Set up and operate portable field transmission equipment outside the studio		P	
IMPLEMENT	Set up and operate computer editing systems, electronic titling systems, video switching equipment and digital video effects units to produce a final product		P	
IMPLEMENT	Schedule use of studio and editing facilities for producers and engineering and maintenance staff	P		
IMPLEMENT	Schedule or dispatch workers, work crews, equipment, or service vehicles to appropriate locations, according to customer requests, specifications or needs, using radios or telephones	P		
IMPLEMENT	Preview scheduled programmes to make sure signals are functioning and programmes are ready for transmission		P	
IMPLEMENT	Perform administrative duties, such as preparing operational reports, distributing rehearsal call sheets and script copies, and arranging for rehearsal quarters		P	P
IMPLEMENT	Organise and maintain compliance, licence and warranty information related to audio and video facilities		P	P
IMPLEMENT	Operate systems to integrate multiple video sources using equipment such as switchers, projectors and effects generators		P	
IMPLEMENT	Operate manual or automated systems to control lighting throughout productions		P	
IMPLEMENT	Operate equipment to produce programmes or broadcast live programmes from virtual locations			E
IMPLEMENT	Operate cameras in any of several different camera mounts, such as stationary, track-mounted or crane-mounted			E
IMPLEMENT	Obtain and assemble data to complete architectural designs, visiting job sites to compile measurements as necessary		P	P



Function	Required capability	FOP#1	FOP#2	FOP#3
IMPLEMENT	Monitor personnel or equipment locations and utilisation to coordinate service and schedules		P	
IMPLEMENT	Monitor broadcasts to make sure programmes conform to station or network policies and regulations		P	P
IMPLEMENT	Manipulate rigging lines, hoists and pulling gear to move or support materials, such as heavy equipment, ships or theatrical sets			E
IMPLEMENT	Manage makeup sheets and take photos to document specific looks and the products used to achieve the looks	P		
IMPLEMENT	Manage equipment and make sure timely repairs are made, including emergency repairs when necessary and possible			P
IMPLEMENT	Manage accurate and reliable labelling and recording of exposed film or digital media		E	
IMPLEMENT	Ensure robust and reliable signal routing to mitigate against breaks in feeds/inputs			P
IMPLEMENT	Ensure accurate and reliable preparation of slates (clapperboards) that describe the scenes being filmed	E		
IMPLEMENT	Create special effects such as vignettes, mosaics and image combining, and add elements such as sound and animation to electronic publications	P		
IMPLEMENT	Compress, digitise, duplicate and store audio and video data		P	
IMPLEMENT	Analyse and maintain data logs for audio-visual activities		E	E
IMPLEMENT	Act as liaison between engineering and production departments			P
ENTERPRISE	Specify and configure power supply equipment and systems according to requirements			P
ENTERPRISE	Evaluate environmental characteristics, such as venue size and lighting plans, to determine makeup requirements			E
ENTERPRISE	Ensure accurate and reliable preparation of key numbers and time codes on materials		P	P
DESIGN	Test lighting equipment function and desired lighting effects	P		



Function	Required capability	FOP#1	FOP#2	FOP#3
DESIGN	Test equipment performance, focus of lens system, diaphragm alignment, lens mounts or film transport, using precision gauges	E		
DESIGN	Select and configure cameras, lighting, audio and related equipment to ensure correct focus, exposure, lighting and recording		P	P
DESIGN	Produce rough and finished graphics and graphic designs		P	P
DESIGN	Produce aircraft cameras, still or motion picture cameras, photographic equipment or frames, using diagrams, blueprints, bench machines, hand tools or power tools			P
DESIGN	Prepare preliminary renderings of proposed exhibits, including detailed construction, layout and material specifications, and diagrams relating to aspects such as special effects or lighting			E
DESIGN	Plan details such as framing, composition, camera movement, sound and actor movement for each shot or scene	P		
DESIGN	Obtain and evaluate information on factors such as reporting formats required, costs or security needs to determine hardware configuration			P
DESIGN	Observe pictures through monitors and direct camera and video staff concerning shading and composition		E	
DESIGN	Manage procurement and curation of set props, such as furniture, pictures, lamps and rugs	P		
DESIGN	Identify and approve equipment and elements required for productions, such as scenery, lights, props, costumes, choreography and music	P		
DESIGN	Devise and apply processes that enable filter options, lens choices and the visual effects of objects being filmed to be defined by photography directors and video operators			P
DESIGN	Develop processes to compute and specify variables such as lighting, shutter angles, filter factors and camera distances			P
DESIGN	Determine specific network hardware or software requirements, such as platforms, interfaces, bandwidths or routine schemas	P		



Function	Required capability	FOP#1	FOP#2	FOP#3
DESIGN	Create and maintain accessible, retrievable computer archives and databases, incorporating current advances in electronic information storage technology	E		E
DESIGN	Create and install special effects as required by the script, mixing chemicals and fabricating needed parts from wood, metal, plaster and clay	P		
DESIGN	Construct and position properties, sets, lighting equipment and other equipment		P	P
DESIGN	Configure equipment, apertures, shutter speeds and camera focus according to a combination of factors, such as lighting, field depth, subject motion, film type and film speed		P	P

RG#2

Function	Required capability	FOP #4	FOP #5	FOP #6	FOP #7	FOP #8	FOP #9
SUPPORT	Update 3D or interactive representations of designs using CAD software			E			
SUPPORT	Undertake development, directing, cinematography and editing to animation to create storyboards that show the flow of the animation and map out key scenes and characters						E
SUPPORT	Test support systems to prepare and alter trace maps, charts, tables, detailed drawings, and 3D optical models of terrain, e.g. using map/satellite data			E			
SUPPORT	Render sequential drawings that can be turned into animated films or advertisements						E
SUPPORT	Produce graphics for broadcasts						E
SUPPORT	Prepare 2D concept layouts or 3D mockups		E				
SUPPORT	Prepare scale drawings or architectural designs, using CAD or other tools		E				
SUPPORT	Prepare and revise initial game sketches using 2D and 3D graphic design software		E				
SUPPORT	Prepare detailed storyboards showing sequence and timing of story development for television production using virtual film and TV production		E				



Function	Required capability	FOP #4	FOP #5	FOP #6	FOP #7	FOP #8	FOP #9
SUPPORT	Participate in the development or testing of electrical aspects of new green technologies, such as lighting, optical data storage devices and energy efficient televisions						E
SUPPORT	Operate equipment to demonstrate proper use or to analyse malfunctions using training					E	
SUPPORT	Observe sets or locations for potential problems and to determine filming and lighting requirements				E		
SUPPORT	Observe sets during rehearsals in order to make sure set elements do not interfere with performance aspects such as cast movement and camera angles				E		
SUPPORT	Manage scripting and planning, and create animated narrative sequences against tight deadlines, using computer software and hand-drawing techniques	E				E	
SUPPORT	Make objects or characters appear lifelike by manipulating light, colour, texture, shadow and transparency, or manipulating static images to give the illusion of motion			E			E
SUPPORT	Interact with teams and crew members responsible for lighting, costumes, makeup and props				P		
SUPPORT	Inspect installed exhibits for conformance to specifications and satisfactory operation of special-effects components				E	E	
SUPPORT	Develop and deploy models to simulate the behaviour of animated objects in the finished sequence					E	
SUPPORT	Design layouts of audio and video equipment and perform upgrades and maintenance	E					
SUPPORT	Design complex graphics and animation, using independent judgment, creativity and computer equipment	E	E				
SUPPORT	Design scale models of set designs, or miniature sets used in filming backgrounds or special effects using 3D technologies	E					
SUPPORT	Design graphics for studio productions	E	E				
SUPPORT	Design computerised graphic effects using VFX software					E	E



Function	Required capability	FOP #4	FOP #5	FOP #6	FOP #7	FOP #8	FOP #9
SUPPORT	Deploy 3D or 4D technologies to geospatial data to allow for new or different analyses or applications		E				
SUPPORT	Create 2D and 3D images depicting objects in motion or illustrating a process, using computer animation or modelling programmes	E					
SUPPORT	Create 3D or interactive representations of designs, using CAD software.	E					
SUPPORT	Create guidelines and templates for video transitions and special effects, such as fades, dissolves, cuts, keys and supers			E			
SUPPORT	Create demonstrator prototypes for presentation to creative and technical staff and management	E					
LOGISTICS	Maintain inventories of audio and videotapes and related supplies				P		
IMPLEMENT	Supervise and coordinate the work of camera, lighting, design and sound crew members					P	
IMPLEMENT	Supervise and assign duties to workers engaged in technical control and production of radio and/or television programmes			E		P	
IMPLEMENT	Specify appropriate operating procedures for cameras, photographic mechanisms or equipment such as range and view finders, shutters, light meters or lens systems				P		
IMPLEMENT	Set up and perform live shots for broadcast				P		
IMPLEMENT	Set up and operate portable field transmission equipment outside the studio						E
IMPLEMENT	Set up and operate computer editing systems, electronic titling systems, video switching equipment and digital video effects units to produce a final product						E
IMPLEMENT	Schedule use of studio and editing facilities for producers and engineering and maintenance staff		E				
IMPLEMENT	Schedule or dispatch workers, work crews, equipment or service vehicles to appropriate locations, according to customer requests, specifications or needs, using radios or telephones		E				



Function	Required capability	FOP #4	FOP #5	FOP #6	FOP #7	FOP #8	FOP #9
IMPLEMENT	Preview scheduled programmes to make sure signals are functioning and programmes are ready for transmission						E
IMPLEMENT	Plan for location-specific issues, such as space limitations, traffic flow patterns and safety concerns		E				
IMPLEMENT	Perform administrative duties, such as preparing operational reports, distributing rehearsal call sheets and script copies, and arranging for rehearsal quarters			E		P	
IMPLEMENT	Participate in multidisciplinary projects in areas such as VR, human-computer interaction or robotics					E	E
IMPLEMENT	Participate in design and production of multimedia campaigns, handling budgeting and scheduling, and assisting with such responsibilities as production coordination, background design and progress tracking			E			
IMPLEMENT	Organise and maintain compliance, licence and warranty information related to audio and video facilities			P	P		
IMPLEMENT	Operate systems to integrate multiple video sources using equipment such as switchers, projectors and effects generators						E
IMPLEMENT	Operate systems that synchronise and equalise pre-recorded dialogue, music and sound effects with visual action of motion pictures or television productions, using control consoles					E	
IMPLEMENT	Operate manual or automated systems to control lighting throughout productions				P		
IMPLEMENT	Operate equipment to produce programmes or broadcast live programmes from virtual locations						E
IMPLEMENT	Operate cameras in any of several different camera mounts, such as stationary, track-mounted or crane-mounted				P		
IMPLEMENT	Obtain and assemble data to complete architectural designs, visiting job sites to compile measurements as necessary					E	E
IMPLEMENT	Monitor personnel or equipment locations and utilisation to coordinate service and schedules				P		



Function	Required capability	FOP #4	FOP #5	FOP #6	FOP #7	FOP #8	FOP #9
IMPLEMENT	Monitor broadcasts to make programmes conform to station or network policies and regulations				P	P	
IMPLEMENT	Manipulate rigging lines, hoists and pulling gear to move or support materials, such as heavy equipment, ships or theatrical sets					E	
IMPLEMENT	Manage makeup sheets and take photos to document specific looks and the products used to achieve the looks				E		
IMPLEMENT	Manage equipment and make sure timely repairs are made, including emergency repairs when necessary and possible						E
IMPLEMENT	Manage camera operators including camera setups, angles, distances, movement, and variables and cues for starting and stopping filming		E				
IMPLEMENT	Ensure robust and reliable signal routing to mitigate against breaks in feeds/inputs				P		
IMPLEMENT	Ensure effective communication and collaboration between technical directors, managers, crew members and writers to discuss and agree details of production, such as photography, script, music, sets and costumes				P	P	
IMPLEMENT	Ensure correct use of zoom lenses, changing images according to specifications and rehearsal instructions					E	
IMPLEMENT	Ensure correct operation of lighting systems in order to meet lighting design plans						E
IMPLEMENT	Ensure communication and collaboration between those in charge of lighting and sound so that those production aspects can be coordinated with set designs or exhibit layouts						E
IMPLEMENT	Ensure accurate and reliable preparation of slates (clapperboards) that describe the scenes being filmed	E					
IMPLEMENT	Ensure the seamless integration of various programming feeds for both receiving and transmission					E	
IMPLEMENT	Direct and coordinate activities of assistants and other personnel during production						E



Function	Required capability	FOP #4	FOP #5	FOP #6	FOP #7	FOP #8	FOP #9
IMPLEMENT	Devise and apply processes to ensure integration of plot, score, sound and graphics into a continuous whole, ensuring close coordination of audio, visual, music, optical or special effects departments	E				E	
IMPLEMENT	Create special effects such as vignettes, mosaics and image combining, and add elements such as sound and animation to electronic publications	E	E				
IMPLEMENT	Convert real objects to animated objects through modelling, using techniques such as optical scanning					E	E
IMPLEMENT	Compress, digitise, duplicate and store audio and video data				E		E
IMPLEMENT	Calibrate and verify accuracy of light meters, shutter diaphragm operation or lens carriers, using timing instruments				E	E	E
IMPLEMENT	Analyse and maintain data logs for audio-visual activities					E	
IMPLEMENT	Act as liaison between engineering and production departments			E		P	
ENTERPRISE	Specify and configure power supply equipment and systems according to requirements			P			
ENTERPRISE	Offer specific training programmes to help workers maintain or improve skills			P	P		
ENTERPRISE	Obtain rights to scripts or other items such as existing video footage			P	P		
ENTERPRISE	Evaluate environmental characteristics, such as venue size and lighting plans, to determine makeup requirements	E					
ENTERPRISE	Estimate set- or exhibit-related costs, including materials, construction and rental of props or locations			P	P		
ENTERPRISE	Ensure accurate and reliable preparation of key numbers and time codes on materials					E	
ENTERPRISE	Discuss production requirements with clients				P		
ENTERPRISE	Develop or apply data mining and ML algorithms	E					
ENTERPRISE	Confer with management and conduct surveys to identify training needs based on projected production processes, changes and other factors			P	P		



Function	Required capability	FOP #4	FOP #5	FOP #6	FOP #7	FOP #8	FOP #9
DESIGN	Use databases and software applications, such as GIS mapping and AI tools	E					
DESIGN	Test lighting equipment function and desired lighting effects			E		E	
DESIGN	Test equipment performance, focus of lens system, diaphragm alignment, lens mounts or film transport, using precision gauges		E				
DESIGN	Select and configure cameras, lighting, audio and related equipment to ensure correct focus, exposure, lighting and recording					E	E
DESIGN	Render drawings, illustrations and sketches of buildings, manufactured products or models, working from sketches, blueprints, memory, models or reference materials					E	E
DESIGN	Recommend purchase of equipment to control dust, temperature or humidity in area of system installation		E				
DESIGN	Produce studio sets, select and configure cameras, audio and lighting equipment to be used during production						E
DESIGN	Produce rough and finished graphics and graphic designs					E	E
DESIGN	Produce aircraft cameras, still or motion picture cameras, photographic equipment or frames, using diagrams, blueprints, bench machines, hand tools or power tools					E	E
DESIGN	Prepare rough drafts and scale working drawings of sets, including floor plans, scenery and properties to be constructed		E				
DESIGN	Prepare preliminary renderings of proposed exhibits, including detailed construction, layout and material specifications, and diagrams relating to aspects such as special effects or lighting		E				
DESIGN	Plan details such as framing, composition, camera movement, sound and actor movement for each shot or scene		E				
DESIGN	Plan and develop pre-production ideas into outlines, scripts, story boards and graphics, using own ideas or specifications of assignments			E			



Function	Required capability	FOP #4	FOP #5	FOP #6	FOP #7	FOP #8	FOP #9
DESIGN	Obtain and evaluate information on factors such as reporting formats required, costs or security needs to determine hardware configuration			P	P		
DESIGN	Observe pictures through monitors and direct camera and video staff concerning shading and composition						E
DESIGN	Manage procurement and curation of set props, such as furniture, pictures, lamps and rugs			E			
DESIGN	Install electrical assemblies and wiring in aircraft camera using appropriate tools						E
DESIGN	Identify and approve equipment and elements required for productions, such as scenery, lights, props, costumes, choreography and music		E				
DESIGN	Establish pace of programmes and sequences of scenes according to time requirements and cast and set accessibility			E			
DESIGN	Devise and apply processes that enable lighting director or production staff to determine lighting requirements		E				
DESIGN	Devise and apply processes that enable filter options, lens choices and the visual effects of objects being filmed to be defined by photography directors and video operators			P			
DESIGN	Develop processes to select settings and locations for films, and plan, schedule and sequence scenes that will be shot at locations		E				
DESIGN	Develop processes to determine desired images and picture composition, selecting and adjusting subjects, equipment and lighting to achieve desired effects		E				
DESIGN	Develop processes to coordinate technical aspects of light, lenses, film, filters and camera settings to achieve the effects sought by directors			P	P		
DESIGN	Develop processes to compute and specify variables such as lighting, shutter angles, filter factors and camera distances		E			E	
DESIGN	Develop post-production workflows for film using structured methods	E	E				



Function	Required capability	FOP #4	FOP #5	FOP #6	FOP #7	FOP #8	FOP #9
DESIGN	Develop computer information resources, providing for data security and control, strategic computing and disaster recovery	E					
DESIGN	Determine system performance standards			E			
DESIGN	Determine specific network hardware or software requirements, such as platforms, interfaces, bandwidths or routine schemas		E				
DESIGN	Define guidance and working practices to maintain makeup during productions as necessary to compensate for lighting changes or to achieve continuity of effect			P	P		
DESIGN	Create and maintain accessible, retrievable computer archives and databases, incorporating current advances in electronic information storage technology	E	E				
DESIGN	Create and install special effects as required by the script, mixing chemicals and fabricating needed parts from wood, metal, plaster and clay	E					
DESIGN	Construct and position properties, sets, lighting equipment and other equipment					E	E
DESIGN	Configure equipment, apertures, shutter speeds and camera focus according to a combination of factors, such as lighting, field depth, subject motion, film type and film speed			P	P		
DESIGN	Assimilate all relevant aspects of formal game design using mock-up screen shots, sample menu layouts, gameplay flow charts and other relevant methods			E			
DESIGN	Assemble devices or equipment to be used in green technology applications, including solar energy, high efficiency solid state lighting, energy management, smart buildings or green processes						E
DESIGN	Analyse user needs and recommend appropriate hardware	E		P			

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