



Ministry
of Defence

Future Combat Air System (FCAS) Digital Strategy



Image courtesy of BAE Systems

Contents

Foreword	2
FCAS Digital Strategy on a Page	3
Context	4
FCAS and GCAP	5
Strategic Alignment	6
Challenges	6
Opportunities	6
FCAS Digital Vision	9
Principles	10
Strategic Ends	
Integrated Digital Environment	11
Digital Engineering	13
Collaborative Working Environments and Infrastructure	15
Data and Information	17
Through-Life Support	19
Technology and Innovation Pipeline	21
People and Skills	23
Digital First Ways of Working	25
Interoperable Digital Warfighter	27
Glossary of Terms	30

Foreword

Combat Air will play a vital role in our military strategic capabilities for decades to come, enabling us to defend the United Kingdom and our allies, and make a decisive contribution to global security. The Future Combat Air System (FCAS) will deliver world leading next generation combat air capabilities, created by world class talent and skills. Among these capabilities is a next-generation fighter jet that is being delivered by the Global Combat Air Programme (GCAP), a trilateral collaboration between the UK, Japan and Italy.

Digital technology is critical to delivering this capability faster than previous generations. The design, production, testing, certification and qualification of the capability will be more digital than previous generations.

The system of systems approach will operate in the battlespace with seamless integration of state-of-the-art digital capabilities to give FCAS sustained combat superiority and information advantage.



Richard Berthon, Director FCAS

Digital is revolutionising Combat Air - how we design, build and fight in a highly advanced digital age. We are creating an adaptable FCAS digital environment to provide assured information and data dynamically across the programme and operations. FCAS will integrate the GCAP digital ecosystem and UK specific elements with wider Royal Air Force (RAF) and Ministry of Defence (MOD) systems, and with partners and allies' digital systems.

To deliver a sixth-generation combat air system, we need to revolutionise our way of thinking and working. A 'Digital First' way of working will promote a culture that encourages continuous learning, utilising the latest technology. We are cultivating a workforce that is highly skilled and adaptable which will be essential to achieving FCAS outcomes. Our innovative approach to accessing emerging technologies through a collaborative effort with industry will ensure cutting-edge capabilities are utilised to deliver FCAS collaboratively, securely and at pace. This will transform the through-life support to the capability, with FCAS responding rapidly to evolving requirements.

FCAS will fundamentally change the way we design and deliver the combat air system, transforming global collaboration through the creation of Collaborative Working Environments and revolutionising the way the combat air sector does digital engineering to enhance efficiency and interoperability. Leveraging advanced integrated digital technologies and data driven decisions, we will maintain Information Advantage and battlespace dominance.

Air Commodore John Fortune, FCAS Chief Data and Information Officer

FCAS Digital Strategy on a Page

Diagnosis: where Digital is today for FCAS

FCAS and GCAP operate largely with traditional fragmented tools, connectivity and approaches. Whilst the transformative potential of digital is well recognised as a critical enabler, FCAS is not yet operating with a Digital First mindset to accelerate potential, improve efficiency and drive development of digital capabilities.

Vision: where Digital needs to be for FCAS

FCAS will be the most digitally advanced global combat air enterprise. With a Digital First mindset, the enterprise will work quicker and more collaboratively than previous generations. Alongside the industrial base and international partners, FCAS will optimise its mission through digitally enabled integration, automation of processes, and continual exploitation of world-leading technologies to maintain information and operational advantage through-life.

Strategic Ends: the foundation for achieving the Vision

The approach to achieving the Vision is focused through nine Strategic Ends.

Integrated Digital Environment. An adaptable FCAS digital environment that provides assured information and data across capabilities and operations, integrating ecosystems across FCAS, GCAP, RAF, wider MOD, partners and allies.	Digital Engineering. A world-leading model-based design and test environment with immersive simulations, AI and data driven processes to dramatically accelerate development cycles, acceptance, certification and qualification through-life.	Collaborative Working Environments and Infrastructure. Transformed global collaborative working environments and infrastructure operating seamlessly cross-domain at multiple security levels to enable advanced digital business, design and development, through-life support and operational capabilities.	Data and Information. A leading-edge data and information management capability exploiting emerging technologies to enhance military advantage and drive development, support and efficiency.
Through-Life Support. Advanced integrated digital technologies are leveraged across support systems to enable faster update cycles and more effective and efficient sustainment through-life.	Technology and Innovation Pipeline. Access to pioneering research and emerging technologies with seamless integration of state-of-the-art capabilities into the digital environment.	People and Skills. A sixth-generation military and civilian workforce that is digitally skilled, adaptable and can proficiently operate through-life.	Digital First Ways of Working. A collaborative culture with a 'Digital First' mindset, utilising cutting-edge digital capabilities and continually learning, to improve efficiency and performance.
			Interoperable Digital Warfighter. A digitally enabled warfighting capability that is seamlessly integrated into the multi-domain battlespace utilising Mission Enablement to maintain military advantage and sustain combat superiority.

Ways and Means: how the Strategic Ends will be achieved

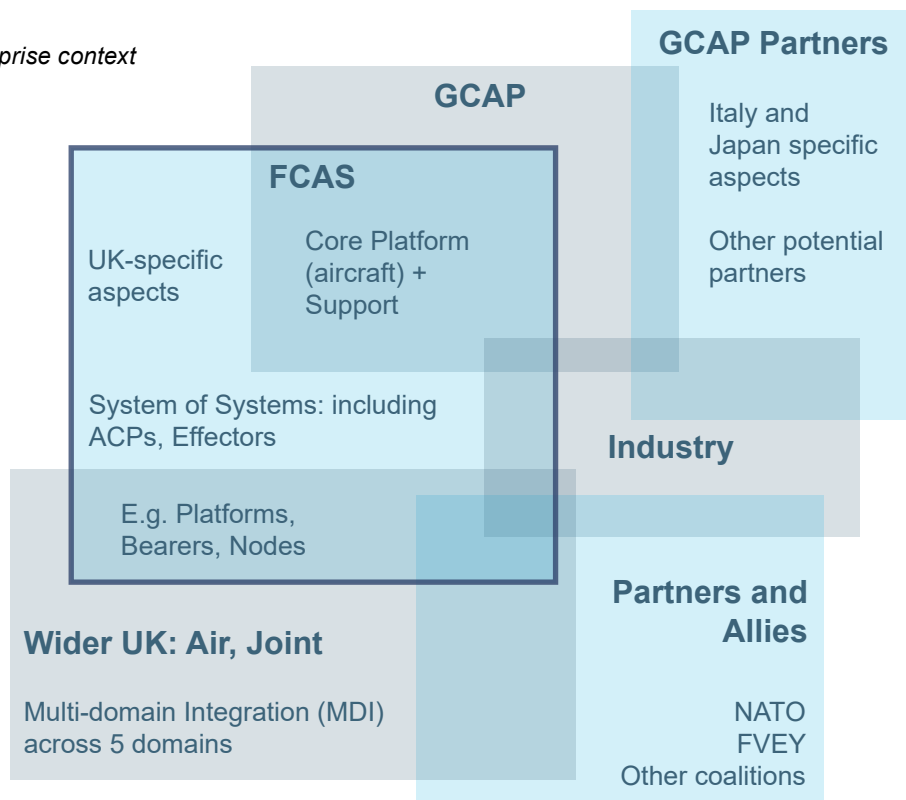
This document is only part of the strategy. The FCAS Digital Plan will explain how the Strategic Ends will be achieved and will be released separately.

Context

The Future Combat Air System (FCAS) is the UK's sixth-generation combat air capability¹, based around a system of systems (SoS) approach to provide a transformative combat air capability integrated across the battlespace. The SoS approach consists of the Core Platform, Autonomous Collaborative Platforms (ACPs), Effectors (e.g. weapons) and a broader digital enterprise which must interoperate with multiple assets across the wider UK environment and with partners and allies.

The Global Combat Air Programme (GCAP) is the international partnership between the UK, Japan and Italy which will design, manufacture, and deliver the next generation Core Platform. FCAS will deliver ACPs, integrate Effectors and manage SoS integration into the RAF and wider UK capabilities. Figure 1 shows this context and the scope of FCAS.

Figure 1: FCAS enterprise context and scope



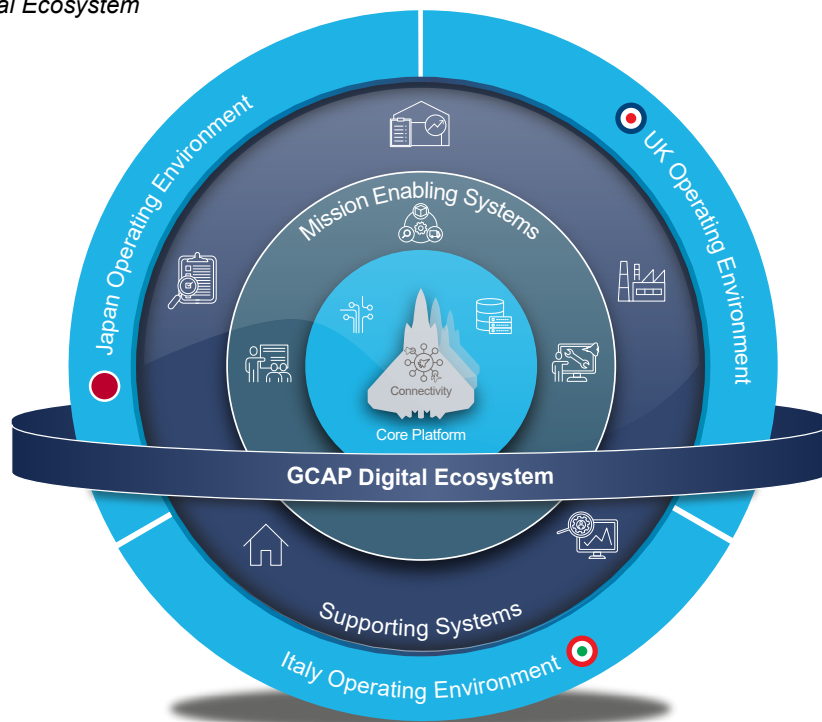
FCAS and GCAP will create an international enterprise with partner MODs and through global industrial collaboration to deliver, operate and sustain the capability through-life. This enterprise will comprise many organisations operating in wider environments, all of which have an increasingly digital way of doing business. Digital capability is a fundamental enabler in delivering the objectives of FCAS and GCAP and more widely across Combat Air and Defence. This is both the digital technology that forms part of the sixth-generation combat air capability and that to enable much improved ways to design, build and support the capability through-life.

¹ A sixth-generation combat air system is a rapidly adaptable and upgradable collection of crewed and uncrewed combat aircraft and supporting systems, which apply open mission systems and multi-spectral stealth to deliver information advantage, battlespace dominance, and disruptive and destructive effects as an integrated part of a multi-domain force.

FCAS and GCAP

GCAP forms the heart of FCAS, centred on the Core Platform along with other engineered systems for mission enablement and support. These are supplemented by further supporting systems, including through-life engineering, modelling and simulation, industrial capabilities and test and evaluation services. There are digital aspects to all systems, and these will be governed to ensure interoperability and integration and enable upgrades through an open architecture approach with agreed standards and common core elements – referred to as the ‘GCAP Digital Ecosystem’.

Figure 2: GCAP Digital Ecosystem



The shaping of the GCAP enterprise is managed collaboratively by the UK MOD and the MODs of Japan and Italy. The GCAP international Government Organisation (GIGO) is the legal treaty-based tri-lateral organisation consisting the UK, Japan and Italy which will place contracts with a single delivery body, Edgewing. Edgewing is a Joint Venture arrangement with lead industry partners from each of the respective nations. FCAS will become the customer of GCAP; procure supplementary systems; and undertake SoS integration.

FCAS must integrate the GCAP Core Platform and related systems, with non-GCAP systems, including ACPs, Effectors and wider UK assets/domains and partners and allies (who may also be involved in the delivery of FCAS, separate to GCAP). There may also be UK-specific systems contracted by FCAS outside of GCAP in order to align with wider UK policy and procurement approaches. An example could be training systems to align with the broader multi-domain approach.

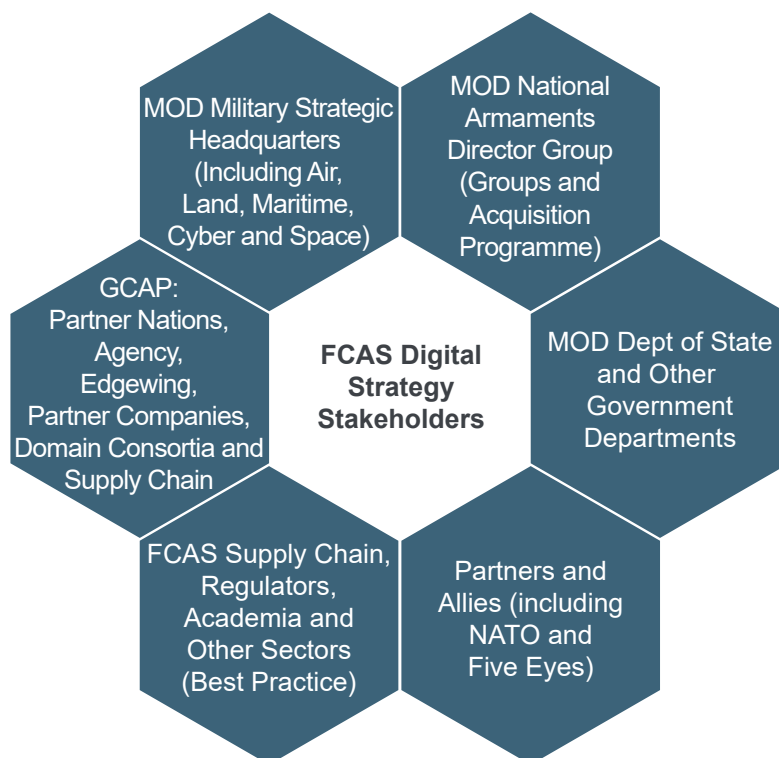
This strategy will be reviewed annually and refreshed accordingly.

Strategic Alignment

This FCAS Digital Strategy must engage a wide range of stakeholders and programmes, aligning with or influencing future developments to meet FCAS needs and ensure overall coherence. Ongoing and systematic alignment across a multitude of

current and future programmes and systems will be needed, including plans, assumptions, risks, dependencies and interfaces. This strategy and planning alignment covers a broad set of stakeholder groups as shown in Figure 3.

Figure 3: Stakeholder and Strategy Map



The GCAP international Government Organisation (GIGO) is the legal treaty-based tri-lateral organisation consisting the UK, Japan and Italy which will place contracts with a single delivery body, Edgewing. Edgewing is a Joint Venture arrangement with lead industry partners from each of the respective nations.

Strategic Alignment

Challenges

- 1. Complex Global enterprise.** Integrating international partners with a broad industrial base, providing global network access and services at all classifications, and developing new technologies across the highly complex global enterprise whilst meeting intellectual property and individual national security requirements poses an exciting challenge to overcome.
- 2. Pace of adoption.** FCAS must adopt, evolve, update, and grow more rapidly than before - in hours and days, rather than weeks and months. The technical challenge of developing and integrating capabilities quicker than any previous combat air generation must be overcome, with systems and technologies updating rapidly at an increased tempo that exceeds that of our adversaries.
- 3. Cyber security and resilience.** Ensuring the cyber resilience of a highly complex digital capability in both development and operational environments will be of the utmost importance. The large attack surface of FCAS makes it a valuable target for adversaries, posing many potential cyber security risks that must be managed and mitigated throughout the life of the capability.

Opportunities

- 1. Stimulate Defence.** The benefits of the investment in digital capabilities for FCAS will be felt across broader Defence, with wider applications and spillover benefits of digital technologies and skills across Defence and the industrial sector.
- 2. Develop skills.** Driving a more digitally skilled workforce across Defence and industry, with specialist digital and engineering skills developing and operating future combat air capabilities, will position the UK as a world-class leader in complex military digital technologies.
- 3. Drive innovation.** The demand for new technologies will drive innovative research and development of cutting-edge capabilities across the industrial sector including Small and Medium Enterprises (SMEs), academia and non-traditional Defence suppliers. This innovation demand will have economic benefits across the UK through the back of UK industry.



Image courtesy of BAE Systems

FCAS Digital Vision

FCAS will be the most digitally advanced global combat air enterprise. With a Digital First mindset, the enterprise will work quicker and more collaboratively than previous generations. Alongside the industrial base and international partners, FCAS will optimise its mission through digitally enabled integration, automation of processes, and continual exploitation of world-leading technologies to maintain information and operational advantage through-life.

Digital is foundational to the sixth-generation operational concept with the GCAP Core Platform acting as an information and decision hub and a net information contributor at the centre of future air and battlespace operations. Digital First ways of working are a key enabler for both the initial development of the capability and through-life support, adaptations and upgrades. The digital transformation of business processes and sectors such as digital engineering are essential to ensuring FCAS is delivered faster than previous capabilities. Continual evolution of technologies and processes and a 'Whole Force' approach with military, government and industry will sustain superior military capability through-life.

The digital capabilities will be secure, integrated, easy to use, continually improved and delivered at scale and pace. These dispersed components (nationally and internationally) will be brought together under the FCAS digital environment centred on GCAP with integration and interoperability to wider UK capabilities, and partners and allies. FCAS will drive digital and data developments across Defence, achieving wider information advantage.



FCAS Digital Vision

Principles

The following principles will be used to guide the implementation of the FCAS Digital Strategy:

- 1. Digital First.** Digital is the key enabler to achieving sixth-generation ways of working. Approaches to opportunities should be as digital as possible.
- 2. Digital resilience.** FCAS is a high value cyber target, with potential catastrophic consequences if compromised. Cyber security must be embedded from the outset and considered a priority throughout.
- 3. Adaptive approach.** Change is inevitable in the fast-paced environment in which FCAS will operate. Tempo is fundamental to maintaining operational advantage. FCAS must accept uncertainty and embrace risk, balancing benefit with risk.
- 4. Whole Force effort.** Working collaboratively with industry and international partners will drive innovation, increase interoperability and stimulate productivity and economic growth.
- 5. Synergy across Defence.** FCAS will draw on and seek to influence planned and existing capabilities in the MOD digital environment where appropriate, to promote integration and reduce duplication.
- 6. Constant evolution.** Continual refresh of digital capabilities to maintain a world-class enterprise and military advantage.
- 7. Trustworthy.** New technologies need to be robust, safe and trustworthy for use.

The purpose of this strategy is to state the strategic direction of digital in FCAS, focusing on ends as expressed through nine Strategic Ends. The Digital Plan will address how these strategic outcomes are to be achieved, outlining the means, ways and plan to realising the Vision.



Strategic Ends

Integrated Digital Environment

An adaptable FCAS digital environment that provides assured information and data across capabilities and operations, integrating ecosystems across FCAS, GCAP, RAF, wider MOD, partners and allies.

The FCAS Digital Environment will encompass entities (capabilities, assets and organisations) and digital components that must interact with the programme and its operating environment. FCAS will orchestrate and integrate this environment to deliver the capability through-life. The GCAP 'Digital Ecosystem' will sit at the heart of FCAS, a set of interconnected digital components (applications, data, system software, interfaces, hardware, infrastructure, people and processes) that interact dynamically. It will be tightly governed by GCAP with rules, standards, architecture and common core elements. Figure 4 envisages the FCAS Digital Environment, with example interfacing entities across the RAF, wider MOD and with partners, allies and industry.

FCAS will fully integrate with wider MOD, ensuring FCAS capabilities are digitally integrated into the broader UK Defence Digital Backbone and multi-domain operational battlespace.

Key considerations are:

- **Through-life interfaces.** Identifying and managing interfacing systems through-life will be a continual process due to the pace of change in defence context and requirements, technology, doctrine and programmes.
- **UK Defence Digital Backbone.** FCAS will adopt and drive the development of the UK Defence Digital Backbone, meeting opportunities and challenges presented by FCAS as they evolve.
- **Balancing MOD and GCAP.** The FCAS Digital Environment must balance MOD and GCAP, adopting and influencing MOD governance, rules, architecture and standards whilst shaping GCAP to align as closely as possible.
- **Security.** The transition to a fully digital enterprise opens many potential attack vectors, making FCAS a high value cyber target, with potential catastrophic consequences if compromised. The scale of risk for embracing a Digital First approach is high. Ensuring digital capabilities are cyber secure and data is protected is essential to embedding cyber resilience across the digital enterprise and crucially, ensuring the capability is not compromised.

Figure 4: The FCAS Digital Environment

FCAS Digital Environment

FCAS will adopt and drive the development of the UK Defence Digital Backbone.

FCAS Digital Environment adopts MOD governance, technical rules/ standards and architecture - and shapes GCAP equivalents.



Digital Engineering

A world-leading model-based design environment with immersive simulations, AI and data driven processes to dramatically accelerate development cycles, acceptance, certification and qualification through-life.

Digital engineering in UK Combat Air will be transformed by FCAS. The approach to developing complex products and systems will be digitally enabled by integrating established engineering disciplines using digital models linked through a Digital Thread. Changes will be seen instantly in different tools, enabling better understanding of designs and elimination of errors early on. The tracing of information through the life-cycle into manufacture, test and acceptance, certification and qualification will reduce the need for physical test, increasing the quality of test activity and making this process quicker than ever before. Designs will be able to respond rapidly to evolving requirements, incorporating new technologies with ease, and achieving improved interoperability. Digital modelling of in-service assets will optimise support through-life via data-driven prognostics. The advances in digital engineering will ensure capabilities are developed faster than previous generations and at a cost low enough to ensure sustainability.



Digital Engineering

Key considerations are:

- **Modelling, simulation and product information.** Model Based Systems Engineering (MBSE), advanced synthetics, Model Based Engineering (MBE) and Product Lifecycle Management (PLM) will form the core of the transformed integrated future digital engineering environment. This is a fundamental change in engineering approach and will be considered holistically across tools, data, workflows, skills and culture.
- **Software approach.** The volume, complexity and integration of software will be far greater than previously, ranging across core aircraft and mission load software, ground training and synthetics, mission data exploitation, logistics and through-life engineering. Changes required include new organisation and development approaches, automated pipelines, and synthetic, scalable test infrastructure, which will ensure the generation of assurance evidence.
- **Data models, architecture, storage, access and movement.** How engineering data is structured, tagged, stored, accessed and moved must be re-thought, architected and governed, to enable data to be accessed seamlessly across security classifications. This is critical to ensuring that MOD can access the required engineering data through-life via the digital thread approach across the enterprise.
- **Industrial enterprise interaction.** The GIGO and Edgewing will operate with unified tools and processes, and whilst the wider enterprise will have some access, they will mainly operate within their existing engineering ecosystems. However, the ability to interact and preserve a digital thread is important, by means of data standards and exchange protocols.
- **Combat Air.** FCAS must align with and drive the digital vision for the RAF and multi-domain approach, ensuring synergies across engineering, support, digital and people aspects.
- **Wider applications.** The digital engineering capabilities that FCAS develops must be available for use across wider MOD. FCAS will drive the transformation of digital engineering across MOD ensuring the benefits of this transformation are realised across the Defence enterprise. The MOD Digital Engineering Centre will be a key enabler to drive this broader activity.
- **Integration.** The digital engineering capabilities across FCAS must integrate with broader MOD engineering capabilities. The tools and workflows that make up the digital engineering capability must interoperate with the GCAP digital ecosystem and wider FCAS digital environment.
- **Digitally secure.** The Digital Thread must have robust cyber security measures in place to ensure data is protected and the digital engineering capability is cyber resilient.

Collaborative Working Environments and Infrastructure

Transformed global collaborative working environments and infrastructure operating seamlessly cross-domain at multiple security levels to enable advanced digital business, design and development, through-life support and operational capabilities.

Collaborative working environments (CWEs) will form a digital foundation for GCAP. These will initially support the development phase enabling digital engineering, business and collaboration services across the globe for multiple organisations at various security classifications with seamless data access and transfer capabilities. They will become an enduring part of the through-life digital environment, linking to other infrastructure, and facilitating digital threads across the enterprise, linking operations with industry support.

The CWE and infrastructure capability for FCAS UK elements will cover ACPs, Effectors, UK-specific systems and SoS integration. Existing interim CWEs will be replaced by enduring solutions.



Collaborative Working Environments and Infrastructure

Key considerations are:

- **Global, scale and classification domains.** The CWEs must operate globally, with unprecedented potential data exchange, storage and connectivity service demand across elevated classifications. Combined, these present a huge challenge, including the need for cross security domain interaction, protection of IP and access management according to user privileges (with potential use of data centric security and zero trust architecture approaches).
- **High Performance Computing (HPC).** HPC will be a critical enabler to support advanced modelling, synthetics and AI applications for development and operations.
- **Through-life infrastructure and MOD integration.** The infrastructure will comprise hardware, computing facilities and communications bearers - fixed and deployed. Some infrastructure, possibly globally, could serve GCAP and FCAS if security provisions allow. Due to its scale and ambition, FCAS will drive development of the UK Defence Digital Backbone, linking across RAF and MOD entities.
- **Cloud.** To achieve the strategic goals and exploit the data assets, FCAS will require access to flexible storage and processing volumes that are only available through hyperscale cloud. The ability to store and process, scaling up and down as required and to bring in specialist infrastructure will be essential, for example large numbers of GPUs for AI model training at all classifications. Truly global access and sharing via secure, scalable platforms that evolve and grow will give enduring strategic military advantage.
- **Wider applications.** The digital collaboration capabilities that FCAS develops will have broader applications across wider MOD and UK government for sharing information and digital collaboration for sensitive technology.
- **Cyber resilience.** The CWEs must be built with security at the forefront. Robust security measures must be in place to ensure CWEs are inherently protected.
- **Infrastructure.** Infrastructure to support the FCAS capability must be digitally enabled, exploiting the latest cutting-edge technologies, improving efficiency. For example, digitally enabled hangars will be essential to supporting a sixth-generation combat air capability.

Data and Information

A leading-edge data and information management capability exploiting emerging technologies to enhance military advantage and drive development, support and efficiency.

FCAS will integrate data at volumes and velocities beyond those of any current combat air system. Data will be treated as a strategic asset, a war winning capability, and managed through-life. It will be prioritised, triaged and integrated, ready for human and machine exploitation.

A master data management service will provide consistent views to different parts of the organisation. Automation and AI will streamline ingestion, including metadata capture, to standardise processes and deliver value through speed and accuracy of information management. A cohesive approach to data governance will provide command, control and co-ordination over the programme. This approach will join up the different and existing governance structures across government, industry and Defence, multi-nationally.



Data and Information

Key considerations are:

- **Scale, handling and retention.** Increasingly large data sets (for example petabytes per aircraft per sortie) creates both opportunity and a data management challenge. The ability to intelligently manage and exploit this will be key to maximising value. Data retention approach and periods must balance value and cost.
- **Transmission optimisation.** Data will be transmitted in volumes previously unseen and at near real-time speeds. Data processing capabilities on-platform will need to intelligently sift the high value data in real-time. Storage architecture will be crucial, considering existing data standards to ensure optimised interoperability with existing platforms.
- **Data types and structure.** Data will exist in multiple formats across many domains, from ISTAR sensor data to pilot speech. The use of common principles, standards and metadata are needed for governance, management and analysis. Data catalogues will help share available information assets. A common data fabric will be essential to multi-domain integration.
- **Digital Targeting Web.** The information being generated, shared and utilised across the battlespace will allow FCAS and cooperating assets to navigate the Observe, Orient, Decide, Act (OODA) loop more effectively by informing better decisions and allowing them to be made at a faster rate, thus enabling Decision Advantage and tempo. This will fundamentally generate strategic and tactical choice in prosecuting mission aims and targeting multi-domain capabilities whilst operating in a congested and contested cyber and electromagnetic environment.
- **Design authority.** FCAS will establish a Digital Design Authority in partnership with the GIGO and national partners to cohere digital approaches and data structures across the programme. For the Core Platform, the Digital Design Authority will need to work alongside Edgewing and the Type Airworthiness Authority to ensure data types are cohered and governed by the appropriate authority.
- **Operational sovereignty and Freedom of Action.** UK must retain sufficient operational and sustainment independence through-life to ensure freedom of action regarding information and data management covering GCAP and wider partners.
- **Access and ownership.** MOD must have access to the appropriate data and exercise sovereignty over data, including accountability and ownership.
- **Data protection.** FCAS must comply with Data Protection Legislation, ensuring the maintenance of confidentiality, integrity and availability of FCAS data.
- **Data as an asset.** Digital Thread technology provides the opportunity for linked, authoritative data assets to be seamlessly accessed and exploited across multiple parties and/or systems. The access, editing rights, security and transmission of data must be appropriately architected to enable faster update cycles and more effective, efficient capability sustainment through-life.

Through-Life Support

Advanced integrated digital technologies are leveraged across support systems to enable faster update cycles and more effective and efficient sustainment through-life.

A Digital First approach to Through-Life Support (TLS) will enable greater integration, automation, data insights and faster decision-making. Through-Life Engineering (TLE) will be digitally transformed with readily available data supported by automation, AI and a digitally skilled workforce. Data will be accessible with appropriate data flow, across domains/systems with minimum 'human in the loop' interaction. This will apply across TLS systems including support of Mission Enablement capabilities, Integrated Product Support, TLE, supply chain and inventory management, training (including synthetics), Prognostic Health Usage and Monitoring Systems (PHUMS), continuing airworthiness management and maintenance.



Image courtesy of BAE Systems

Through-Life Support

Key considerations are:

- **Data.** Seamless sharing of data across system boundaries into a wider Defence support information environment will be critical.
- **Integration of digital design into TLS.** Some subjects will require close integration between the aircraft, TLS and digital enablers teams. The availability of data will be essential to faster and more efficient support through-life.
There will need to be integrated design processes and governance, and clear divisions of responsibilities, for example between the aircraft Design Authority and Digital Design Authority.
- **Integration and dependencies.** GCAP TLS systems will need to integrate with the RAF, across all domains and wider MOD programmes and systems. FCAS/GCAP will engage, influence and in some cases drive the development of new support systems and standards.
- **UK specific systems.** UK specific support systems, products and services, for example collective training systems, will need to align with GCAP and wider systems procurement/capability programmes and services.
- **Synergise across Defence.** FCAS will seek to draw on planned and existing capabilities and data functions across the MOD digital environment. Access to Joint Support as well as RAF Support will be a key enabler for support through-life. Ensuring common data structures and controls are embedded into TLS functions will improve system interoperability through-life.
- **Digital modelling.** Digital models of assets and systems, some dynamic and in real time, will improve efficiency across support, configuration and prognostics. Digital models will be utilised across multiple complementary synthetic environments for a range of uses such as test and evaluation, training, and weapons integration.
- **Evolution.** TLS capabilities must evolve to keep pace with threats and technological advancements. Security of these capabilities must also evolve.

Technology and Innovation Pipeline

Access to pioneering research and emerging technologies with seamless integration of state-of-the-art capabilities into the digital environment.

To maintain advantage in a fast changing and high threat environment, FCAS will evolve its digital capabilities through-life.

The establishment of an innovation pipeline for FCAS will ensure access to and integration of cutting-edge technology. This will not only accelerate the delivery of the capability but ensure continual evolution through-life. The digital pipeline will form part of the broader FCAS innovation pipeline and will align with wider Defence innovation initiatives. Alignment with the GIGO and Edgewing will also be an important mechanism to work collaboratively with the industrial base for GCAP aspects.

The innovation pipeline will provide FCAS with access to academia, SMEs, and horizon scanning, assessing the maturity and benefits of potential emerging technologies. Access to advanced technologies will ensure FCAS can operate and maintain cyber resilience in a post quantum world.

FCAS will stimulate a vibrant and sustainable industrial base, contributing to UK economic benefit through the backing of UK industry.

Vision for UK Defence by 2035:

A leading tech-enabled defence power, with an Integrated Force that deters, fights, and wins through constant innovation at wartime pace (SDR 2025).



Technology and Innovation Pipeline

Key considerations are:

- **Innovation led.** FCAS must embrace its role in seeding innovation and growth, in Defence and the industrial base. By adopting an innovation led approach FCAS will rapidly adopt new technology and push the boundaries on innovative thinking, driving demand into academia and the industrial base.
- **Pipeline alignment.** With an array of innovation pipelines across Defence, FCAS must align with existing innovation pipelines to streamline effort, improve efficiency and promote a collaborative approach.
- **Adopting new technologies.** Advances in quantum computing, AI, machine learning, autonomy and digitally enabled weapons is redefining warfare. FCAS must adopt new technologies to maintain pace with adversaries and sustain air dominance.
- **Accelerated pace.** The future of warfighting lies in the accelerated pace of adoption of the latest technology and innovation. FCAS must set a new pace for speed of adoption as the leading combat air capability.
- **Economic growth.** The innovation demand into the industrial base will stimulate productivity and economic growth, creating a thriving industrial base. For example, the 2025 Strategic Defence Review² stated an investment into world-leading innovation in autonomous systems will boost UK export potential.
- **Industry-backed.** The success of the innovation pipeline relies on the backing of UK industry and academia. FCAS must revolutionise the approach to innovation through the forging of partnerships with industry, including SMEs, and academia.

² [Strategic Defence Review 2025 – Making Britain Safer: secure at home, strong abroad](#)

People and Skills

A sixth-generation military and civilian workforce that is digitally skilled, adaptable and can proficiently operate through-life.

The Digital First approach to FCAS is as much about the people as it is about data and technology. Effective delivery and exploitation of digital capabilities will require a transformed workforce with digital skills embedded across the enterprise.

The FCAS enterprise will comprise an unrivalled workforce that is highly skilled and adaptable to achieve its outcomes through-life. The diverse workforce consisting of military and civilian personnel working collaboratively with industry to push boundaries, drive innovative new ways of working and maintain operational advantage. A Whole Force effort will be adopted across GCAP, the broader FCAS enterprise, and the in-service team that will operate and support the capability through-life.

A digitally native workforce will have the right roles, skills and mix of people across the enterprise. The workforce must be digitally inquisitive and open to working in a complex environment with evolving digital skills requirements. Advocating diversity and inclusivity, FCAS will create an international enterprise through industry partnership, with the correct skill set, that is digitally skilled across all disciplines.

FCAS will energise the Combat Air industrial base and opportunities for collaborative approaches to training and development across the enterprise will be encouraged.



People and Skills

Key considerations are:

- **Digital First culture.** To shift the culture across the enterprise towards a Digital First mindset, digital leadership will be a key enabler, inspiring the workforce to embrace change and drive the digital transformation.
- **Planning for the future.** To ensure the future workforce is suitably skilled, early interventions will be required. Both MOD and industry will need skilled personnel – a collaborative approach to training, upskilling, and campaigns at schools and universities will be needed.
- **Professions.** Achieving a digitally native workforce across the enterprise will require digital skills across all professions, not just those deemed ‘digital roles’. The use of ‘digital personas’ will aid in the understanding of the impact on existing and future roles. For example, engineers in the RAF will be required to be more digitally skilled than ever before. The definitions of professions in the RAF will need to be reviewed.
- **Training pathways.** The FCAS programme workforce will need continuous upskilling of their digital skills.
Training programmes need to be integrated with broader civil service initiatives and military specialisation training. Training requirements will need to be kept up to date and closely linked to innovation pathways for new digital toolkits.
- **Through-life.** The training requirements for digital skills will evolve and develop as new technology emerges. The digital skills for FCAS need to be considered through-life.
- **Diverse workforce.** To recruit and retain the highly skilled workforce required, FCAS will seek to break down barriers to the recruitment of a diverse workforce and support the retention of highly skilled staff by making the working environment inclusive.
- **Cyber aware.** The increasingly digital way of doing business means an increase in attack vector. Every person interacting with the FCAS digital environment has a role to play in ensuring its security. People across the enterprise must be cyber aware and exhibit the appropriate cyber security behaviours.

Digital First Ways of Working

A collaborative culture with a Digital First mindset, utilising cutting-edge digital capabilities and continually learning, to improve efficiency and performance.

A Digital First way of working encompasses the combined exploitation of latest technologies, processes and information to drive innovation for competitive advantage. The FCAS enterprise will foster a digital mindset and cultivate a culture of prioritising digital capabilities to optimise working. A Digital First approach means facing every new opportunity or problem with the assumption that the solution should be as digital as possible. This will apply to all areas of the FCAS enterprise, from the concept phase to the supply chain, through to the military and battlespace exploitation of information advantage and multi-domain integration.

The collaboration of people, processes and technologies working harmoniously between the virtual and physical world will optimise efficiency and effectiveness, ensuring the FCAS workforce maintains competitive advantage. Data driven decisions and the exploitation of AI insights will be used to improve productivity, reduce timescales and cost. Adopting and driving the UK Defence Digital Backbone, linking to our international partners, will be fundamental to achieving this vision.

The FCAS enterprise will promote a culture that embraces innovation, collaboration and continuous improvement. A Digital First mindset will ensure digital is a default approach to working. Utilising a cutting-edge future toolkit, the FCAS workforce will be world-leading in its approach to working in a complex, ever evolving, digital age.



Digital First Ways of Working

Key considerations are:

- **Cultural shift.** Changing ways of working across the enterprise could be a challenge. Resistance to change and a digital skills gap will need to be overcome to achieve a harmonious workforce that embraces change.
- **Technology.** The exploitation of the latest emerging technologies will require continuous co-creation, collaboration and upskilling. Ways of working will need to be adaptive and upskilling focused to ensure the workforce is skilled in exploiting the latest technologies.
- **Continuous improvement.** The nature of a Digital First approach promotes a culture of continuous improvement and development. The FCAS culture must embrace change. Enablers to achieving this will be the accessibility of training and promoting of development and upskilling – prioritising learning in a busy environment.
- **Security protocols.** Digitally enhanced ways of working go hand in hand with embracing information and cyber security protocols. Robust measures must be in place to protect data, and security must be embedded into the culture.
- **International and industrial collaboration.** The ability to co-create across the globe means faster development with greater collaboration with international and industrial partners.
- **Economic growth.** This innovative approach to working will mean military, operational and competitive advantage for Defence and the industrial base. It will generate a sustainable, highly skilled workforce that benefits economic prosperity.

Interoperable Digital Warfighter

A digitally enabled warfighting capability that is seamlessly integrated into the multi-domain battlespace utilising Mission Enablement to maintain military advantage and sustain combat superiority.

Digitally enhanced strategic air power is vital to defend, protect and enhance the resilience of the UK. The ability to deter and defeat potential adversaries through digitally enabled information and decision advantage, at a tempo they cannot match, and freedom of action is crucial for achieving control of the air and battlespace dominance.

The advances in technology will redefine warfare. As the leading combat air capability, FCAS will set a new pace for speed of adoption of cutting-edge digital technologies and innovation, continually upgrading and evolving to counter threats and shape global security. The advantage of FCAS will be its tempo of adaptation and interoperability through intelligent architecture across domains and all relevant platforms.

The digital environment will enable the flow of information to produce a lethal and agile Integrated Force that is greater than the sum of its parts. Capabilities will be digitally integrated across the wider multi-domain network connectivity providing greater efficiency, resilience and information advantage.



Interoperable Digital Warfighter

Key considerations are:

- **Integrated by design.** FCAS will fight in a digitally integrated combat force. This united effort relies on seamless integration of digital capabilities for agility and lethality. FCAS must ensure its foundational enablers are coherent with the broader domains. The exploitation of AI and utilising common synthetic environments and networks will digitally enable the multi-domain force.
- **Partners and Allies.** FCAS will operate in different configurations: as a sovereign force, as a NATO member, as a Five Eyes Partner and as a GCAP partner. FCAS must be underpinned by a common digital foundation that can be integrated with necessary configurations. The FCAS capability will be recognisable to partners and allies but concealed from adversaries.
- **Mission Enablement.** The capability to support and prepare the delivery of the mission and conduct post-mission support to augment and improve platform capabilities, tactics and decision making. It caters for input from and output to multi-domain information and intelligence sources.
- **Interoperability.** FCAS systems and capabilities will be streamlined and intelligent in their architecture, enabling seamless adaptability and real-time communication cross domain and with other platforms. FCAS will operate and remain connected in contested environments where it is not safe for other platforms to do so, making the whole operating force more effective.
- **Threat.** To counter threats throughout the life of the capability, FCAS must continue to evolve as adversary threats do. Utilising intelligence, information and in-mission adaptability to achieve maximum effect will be essential to FCAS' ability to fight in an unpredictable technologically advanced threat environment.
- **Digital Targeting Web.** FCAS 'sensors', 'deciders' and 'effectors' will be part of the digital battlespace sharing information to increase collective survivability and lethality, enabling faster and more effective kill chains, as part of a kill web, than the adversary.
- **Crewed, uncrewed, autonomous.** The combination of crewed, uncrewed and autonomous aircraft, effectors and multi-domain network connectivity that make up FCAS must be digitally enabled with secure data flows and AI-powered technology. The Defence Uncrewed Systems Centre will be a key enabler to interoperability of ACPs into the wider domain.



Image courtesy of BAE Systems

Glossary of Terms

Term	Description
Autonomous Collaborative Platforms (ACPs)	A series of uncrewed vehicles which demonstrate autonomous behaviour and are able to operate in a collaborative manner with other assets. They constitute a portfolio of activity to deliver additive capability to the RAF.
AI	Artificial intelligence.
Collaborative Working Environment (CWE)	A technical solution that will enable all parties to access a single IT environment.
Core Platform	The aircraft that sits at the centre of GCAP and FCAS.
Digital Engineering	Digital Engineering is a digitally enabled approach to developing complex products, systems, and sub-systems by integrating established engineering disciplines using digital models linked through a 'digital thread'.
Digital First	A mindset seeking to leverage modern technology and information for competitive advantage.
Digital Targeting Web	The digital targeting web would connect 'sensors', 'deciders', and 'effectors'. This creates choice and speed in deciding how to degrade or destroy an identified target across domains and in a contested cyber and electromagnetic domain.
Digital Thread	The collection of linked authoritative digital engineering information which will enable FCAS to implement a truly integrated digital engineering ecosystem using authoritative sources of truth as a continuum across disciplines.
FCAS Digital Environment	The FCAS digital environment encompasses the capabilities, assets and organisations that fall within the FCAS programme, and which interact with its operating environment to deliver the required military capability.
System of Systems	A configuration of systems in which component systems can be added/removed during use, with each providing useful services individually, but can be combined to create an effect greater than the sum of its parts.
Freedom of Action	The ability to operate, maintain, and refresh certain capabilities effectively, without being dependent on others.

Glossary of Terms

Term	Description
Future Combat Air System (FCAS)	The UK's sixth-generation combat air system of systems.
GCAP Digital Ecosystem	The GCAP Digital Ecosystem is a set of interconnected digital components (applications, data, system software, interfaces, hardware, infrastructure, people and processes) that interact dynamically to provide information and data where and when required, whilst adapting to diverse conditions and emerging technologies.
GCAP International Government Organisation (GIGO)	The legal treaty-based tri-lateral organisation consisting the UK, Japan and Italy which will place contracts with a single delivery body, Edgewing.
Global Combat Air Programme (GCAP)	The trilateral programme between the UK, Italy and Japan to deliver the Core Platform.
GPU	Graphics Processing Unit.
Information advantage	The credible advantage gained through the continuous, adaptive, decisive and resilient employment of information and information systems.
IP	Intellectual property.
ISTAR	Intelligence, Surveillance, Target Acquisition, and Reconnaissance.
Joint Venture (JV)	The single supplier organisation for GCAP - Edgewing.
OODA	Observe, orient, decide, act loop.
SDR	Strategic Defence Review.
Secure By Design	Embedding cyber security practices in digital delivery from the outset and securing capabilities through continuous risk management.
SMEs	Small and Medium-sized Enterprises.
Through-Life Support (TLS)	The continual management of and support to a capability throughout the life cycle, from initial design to disposal.
Whole Force	Collaborative working between the military, government, industry and international partners.

