Defence and Security

Entry 2019

Postgraduate courses in:
Engineering
Leadership and Management
Technology
Cranfield University

We are an exclusively postgraduate UK university with long-standing relationships with some of the most prestigious global companies. Our close collaboration with industry, and passion for the areas we operate in, will help your career.

Exclusively postgraduate
A research-focused professional community

81%
of our research is world-leading or internationally excellent

Over £70 million
of external investment in new facilities over the past three years

Five-time winner of the Queen's Anniversary Prize for Higher and Further Education

A professional network of 60,000+ alumni

96%of our graduates are employed or in further study within 6 months (DLHE longitudinal 2017)

4,600+ learners

As we are postgraduate only, we are not listed in league tables that help compare undergraduate universities, such as The Times World Rankings and The Complete University Guide.

“Cranfield Defence and Security has enjoyed a close working relationship since the Defence Academy was founded in 2002. Defence and Security's deep expertise and reputation are key to ensuring the postgraduate education required of UK defence is world-leading.”

Air Vice-Marshal Chris Luck MBE, Chief Executive, Defence Academy and Commandant Joint Services Command and Staff College
Reasons to study **Defence and Security** with us

1. **Industry links**
   Our courses are regularly reviewed by an advisory panel of leading industry professionals to ensure the content is relevant and meets the expectations of employers. We also have a number of guest lectures, including talks from partner organisations.

2. **Learning from the best academics**
   We attract high-quality staff from around the world, who bring a diverse mix of backgrounds and experiences, to create a rich research and teaching environment.

3. **Outstanding facilities**
   Our unique relationship with the UK Ministry of Defence allows access to world-class, secure facilities, many of which are unique in the university sector. These support students in applying their research and learning. The Decision Analysis and Risk Management Laboratory (DARM), Cranfield Ordnance Test and Evaluation Centre (COTEC), Simulation and Synthetic Environment Laboratory (SSEL) and Engineering Dynamics Centre are just a few of the exceptional, purpose-built testing units available.

4. **Teaching informed by research**
   Our research in the fields of engineering, leadership and management and technology ensures that our teaching is relevant and current.

5. **Networking opportunities**
   You will have opportunities to meet and network with valuable industry contacts through attending our Symposia at Shrivenham events. After graduation, support continues from the alumni team, enabling networking and continuing professional development.

6. **Work on real-world projects**
   A number of student research projects focus on finding solutions to real-world problems, working on developments initiated by industry.

7. **Funding opportunities**
   You may be eligible for the bursaries and scholarships that are available for help with fees and/or living expenses. Please see page 30 for more information.
Defence and Security courses

Cranfield is one of the world’s leading universities for defence and security education, research and consultancy. Addressing the changing needs of an evolving sector, we provide specialist knowledge to industry, security and emergency services, military, governments and NGOs, underpinning defence and security sector reform around the world. As a postgraduate academic provider to the UK’s Ministry of Defence, we offer a unique gateway to delivering practical education and solutions that make a real difference to the lives of military, security and civilian personnel.

Our academics’ expertise ranges from energetics and defence acquisition to international stabilisation and cyber security. These are grouped into three specialisation streams, enabling you to focus on specific areas of interest.

Defence and Security courses specialisation streams

Engineering
Tools for both military and civilian applications require specialist engineering expertise, to adapt conventional engineering techniques for deployment in this industry. Ranging from surveillance to communication systems through to guided weapon systems, this group of courses will provide you with the skills you need in an engineering career in the defence or security sectors. See pages 6 to 9 for a list of courses in this stream.

Leadership and management
Drawing on established expertise in international security and defence policy, analysis and management, this group of courses prepare you for a management and leadership career specifically focused on the needs of the defence and security sector. Whether your focus is on private enterprise or government management, this subject stream will cover aspects of change management through to acquisition techniques, as well as strategic capacity building. See pages 10 to 11 for a list of courses in this stream.

Technology
Technology is becoming an increasingly important aid to information in a modern defence and security setting. Designing appropriate technology to support the effective collection of data to deploy appropriate technology systems requires extensive expertise. Choose from subjects ranging from operational research through to application modelling and simulation to gain the critical skills needed to manage complex challenges in this growing sector. See pages 12 to 14 for a list of courses in this stream.
Course structure

There are two course structures for you to choose from to study our specialist, sector-facing master’s courses. You can select a course shown on pages 6 to 14 – the typical course structure for this format is shown below. Alternatively customise your degree in our Defence and Security Programme which you can read about on pages 16 to 21.

The below diagram is not indicative of all courses. Please check your course structure on our website for more detailed information, including the weight of each phase and full- or part-time course structure variations.

A diverse learning experience, providing the knowledge you need to excel in your chosen field.

An independent and original investigation which is related to a specific area of the syllabus.

Taught programme

Individual thesis

A
B

60%

120 credits, 1200 hours

40%

80 credits, 800 hours

Registration

200 credits, 2000 hours

Completion
Designed to develop your knowledge and skills in engineering principles and practices within the defence and security sector, our courses build on a wide variety of capabilities across the discipline. They will enable you to analyse emerging technologies to aide future defence needs, and apply engineering concepts to a range of complex defence challenges within ethical and regulatory requirements.

To keep our courses relevant and up-to-date, modules are subject to change. Modules typically form 60% of the course content, with the project or thesis making up the other 40% (see page 5). The information in this brochure regarding the number of modules required applies to the MSc. Please see the website for the PgCert or PgDip requirements and further module details.

### Communications Electronic Warfare

This PgCert covers a selection of communications electronic warfare topics relevant to military systems, such as the technical management of military radar, electro-optics and infrared sensor systems.

**Compulsory modules**
- Communications Electronic Warfare,
- Communications Principles,
- Communications Systems,
- Electromagnetic Propagation and Devices,
- Information Networks,
- Signal Processing, Statistics and Analysis.

### Defence and Security (Engineering)

*Part-time only*

Collectively known as the Defence and Security Programme, the different MSc routes allow you to customise your degree and build your skills in engineering disciplines within the defence and security sector. Choose a route to suit your individual learning pathway. Read more about the Defence and Security Programme, including the different course structure, on pages 16-21.

**MSc route:** Choose selected modules from a variety of defence and security courses in the engineering stream, and some from across all the streams, to suit your specific area of interest, broadening or deepening your knowledge.

**MSc capstone route:** Perfect for those who would like to apply their learning directly to their work, the capstone portfolio emphasises business application and innovation to enable you to tailor your learning specifically around your topic. This route combines an equal percentage of taught and research. You will undertake 200 credits, with 100 credits in the taught phase and 100 credits within the portfolio phase.
Explosive Ordnance Engineering (accredited – see page 25) MSc, PgDip, PgCert

Designed to provide the advanced academic background necessary to contribute effectively to technically demanding projects in the field of explosive and explosion ordnance engineering, this course is suitable for civil servants, serving officers in the army, navy and air force and civilians employed in the explosives and defence industries, from both the UK and overseas.

Compulsory modules

- Computer Modelling Tools in Explosive Ordnance Engineering,
- Delivery Systems,
- Future Developments: Scanning the Horizon in Explosive Ordnance Engineering,
- Gun Propellants,
- Introduction to Explosives,
- Introduction to Pyrotechnics,
- Manufacture and Materials Properties of Explosives,
- Munitions and Target Response,
- Research Methodology,
- Testing and Evaluation of Explosives,
- Transitions to Detonations.

Elective modules (select 25 credits)

- Design for Munitions Safety (5 credits),
- Risk, Assessment for Explosives (5 credits),
- Rocket Motors and Propellants (10 credits),
- Advanced Pyrotechnics (5 credits),
- Explosives and the Environment (5 credits),
- Commercial Explosives (10 credits).

Guided Weapon Systems (accredited – see page 25) MSc, PgDip, PgCert

This course is suitable for those officers seeking to work with military guided weapon systems in the MOD, and in trials and training establishments. You will gain an understanding of the principles of guided weapon systems technology and all interrelated and multidisciplinary elements of the complete systems design process.

Compulsory modules

- Electro-optics and Infrared Systems 1,
- Electro-optics and Infrared Systems 2,
- Guided Weapon Applications – Control and Guidance,
- Guided Weapon Applications – Propulsion and Aerodynamics,
- Guided Weapon Control Theory,
- Guided Weapon Propulsion and Aerodynamics Theory,
- Guided Weapon Structures, Aeroelasticity and Power Supplies,
- Guided Weapon Systems,
- Guided Weapon Warheads, Explosives and Material,
- Radar Electronic Warfare,
- Radar Principles,
- Signal Processing, Statistics and Analysis.

Gun Systems Design MSc, PgDip, PgCert

This unique course covers the essential technology required for participants to take a lead role within their organisations on specification, design and development of gun systems. It offers education and training in selected weapons systems and provides you with the depth of knowledge to undertake engineering analysis or the evaluation of relevant sub systems.

Compulsory modules

- Armoured Fighting Vehicle and Weapon Systems,
- Element Design,
- Finite Element Methods in Engineering,
- Fundamentals of Ballistics,
- Ordnance Design,
- Military Vehicle Propulsion and Dynamics,
- Modelling, Simulation and Control,
- Solid Modelling CAD,
- Survivability,
- Vehicle Systems Integration,
- Weapon Systems Technology.

Elective modules (choose one)

- Guided Weapons,
- Light Weapon Design,
- Reliability and Systems Effectiveness,
- Rocket Motors and Propellants,
- Uninhabited Military Vehicle Systems.
Military Electronics Systems Engineering  
(MSc, PgDip)  

This course will provide you with a high level of understanding and detailed knowledge of military communications and sensor systems, especially in electronic warfare. In addition, you can supplement your learning with an in-depth investigation into an area of electronic warfare to further enhance your analytical skills.

**Compulsory modules**

- Communications Principles,
- Communications Systems,
- Electromagnetic Propagation and Devices,
- Electro-optics and Infrared Systems 1,
- Radar Principles,
- Signal Processing, Statistics and Analysis.

**Elective modules (choose six)**

- Advanced Radar,
- Advanced Sensor Data Processing,
- Communications Electronic Warfare,
- Electro-optics and Infrared Systems 2,
- Foundations of Modelling and Simulation,
- Information Networks,
- Radar Electronic Warfare.

"The qualification is internationally recognised and held by a lot of senior officials within the military or aerospace companies. The degree will benefit my future career aspects whether in my current place of work or an alternative company."

**Alex Bragg**, Engineer Officer, Royal Air Force, current student, (Military Aerospace and Airworthiness MSc)
**Military Vehicle Technology**

This course is for military officers, defence industry staff and government staff in preparation for senior posts in project management teams concerned with the design, development, procurement and operation of military vehicles. You will cover all aspects of vehicle logistics and technology of military fighting, and be able to choose areas of specialisation.

**Compulsory modules**

- Armoured Fighting Vehicle and Weapon Systems,
- Military Vehicle Dynamics,
- Modelling, Simulation and Control,
- Solid Modelling CAD,
- Survivability,
- Finite Element Methods in Engineering,
- Military Vehicle Propulsion,
- Weapon System Technology,
- Vehicle Systems Integration.

**Elective modules**

Either choose two:

- Element Design,
- Fundamentals of Ballistics,
- Guided Weapons,
- Light Weapon Design,
- Military Vehicle Propulsion and Dynamics,
- Reliability and System Effectiveness,
- Rocket Motors and Propellants,
- Uninhabited Military Vehicle System.

Or choose one:

- Ordnance Design.

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**Sensors Electronic Warfare**

This PgCert covers a selection of sensors electronic warfare topics relevant to military systems, such as the technical management of military radar, electro-optics and infrared sensor systems.

**Compulsory modules**

- Electromagnetic Propagation and Devices,
- Electro-optics and Infrared Systems 1,
- Electro-optics and Infrared Systems 2,
- Radar Electronic Warfare,
- Radar Principles,
- Signal Processing, Statistics and Analysis.

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**Vehicle and Weapon Engineering (USA delivery)**

Delivered in Detroit, Michigan, USA, this course will provide you with the technical knowledge and understanding of weapon systems and military vehicles to make you effective in their specification, design, development and assessment. You will learn all aspects of technology of military fighting and logistics vehicles, and can choose to specialise in either vehicles or weapons.

**Compulsory modules**

- Armoured Fighting Vehicle and Weapon Systems,
- Electric Drive Technologies,
- Fighting Vehicle Design,
- Finite Element Methods in Engineering,
- Fundamentals of Ballistics,
- Light Weapon Design,
- Military Autonomous Vehicles,
- Modelling, Simulation and Control,
- Reliability and System Effectiveness,
- Survivability,
- Systems Engineering and Assured Performance,
- Vehicle Systems Integration,
- Weapon System Technology.

**Elective modules (select weapons or vehicles specialisation)**

**Weapons (complete both modules below)**

- Gun Systems Design,
- Military Vehicle Propulsion and Dynamics.

**Vehicles (complete both modules below)**

- Military Vehicle Propulsion,
- Military Vehicle Dynamics.
Leadership and Management courses

The application of management and leadership concepts is key to the defence and security sector. These courses will enable you to evaluate and apply appropriate analysis tools and techniques for solving complex and uncertain problems, and drive future defence and security strategy.

To keep our courses relevant and up-to-date, modules are subject to change. Modules typically form 60% of the course content, with the project or thesis making up the other 40% (see page 5). The information in this brochure regarding the number of modules required applies to the MSc. Please see the website for the PgCert or PgDip requirements and further module details.

Defence Acquisition Management
(accredited – see page 25)

Whether you are involved in establishing or managing capability requirements, in procurement, commercial or contracting activities, or developing and implementing through-life support or logistics solutions, this course provides the knowledge and understanding to develop the critical skills required for effective management of defence acquisition.

**Compulsory modules**
- Commercial Relationships in the Defence Environment,
- Cost Estimation and Planning,
- Defence Capability Management,
- Efficient and Effective Through-life Support,
- Financing Acquisition,
- Managing Acquisition Change,
- Programme and Project Management,
- Research Methods,
- Strategic Management and Introduction to Acquisition,
- Supply Network Management in Defence and the Commercial Environment,
- The International Dimension of Defence Acquisition.

**Elective modules (choose two)**
- Decision Analysis and Modelling Support,
- Human Centric Systems Engineering,
- Knowledge in Defence,
- Sustainability in Defence.

Defence and Security Export (part-time only)

This course is for those working within the defence and security sector who are looking to expand their knowledge in defence and security marketing. You will explore key aspects of defence exports, including spanning strategic trade controls, compliance, offset and negotiation.

**Compulsory modules**
- Defence and Security Marketing,
- Defence and Security Offset,
- Legal Ethical and Political Defence and Security Frameworks,
- Negotiations,
- Strategic Trade Controls and Compliance.
Defence Leadership
(part-time only, accredited – see page 25)

Leadership has always been a critical element of organisational success, but only recently has its value been adequately recognised in an educational context. The scope of this MSc covers defence and the wider security sector.

Compulsory modules
- Contemporary Defence Leadership Studies,
- Defence Sector and Organisational Behaviour,
- Global Security: Culture and Complexity,
- Global Security: Emerging Challenges,
- Introductory Studies and Critical Thinking,
- Leadership Development in Defence,
- Leadership Studies – Classical and Modern,
- Leading Change and Innovation,
- National Security: Resilience and Crisis,
- Foundations of Defence Project and Programme Management,
- Psychology of Leadership,
- Research Methods,
- Strategic Management in Defence.

Defence and Security
(Leadership and Management)
(Part-time only)

Collectively known as the Defence and Security Programme, the different MSc routes allow you to customise your degree and build your skills in leadership and management disciplines within the defence and security sector. Choose a route to suit your individual learning pathway. Read more about the Defence and Security Programme, including the different course structure, on pages 16-21.

MSc route: Choose selected modules from a variety of defence and security courses in the leadership and management stream, and some from across all the streams, to suit your specific area of interest, broadening or deepening your knowledge.

MSc capstone route: Perfect for those who would like to apply their learning directly to their work, the capstone portfolio emphasises business application and innovation to enable you to tailor your learning specifically around your topic. This route combines an equal percentage of taught and research. You will undertake 200 credits, with 100 credits in the taught phase and 100 credits within the portfolio phase.
Equip yourself with a range of models, tools and skills to assess risk and propose innovative technological solutions for products, systems, components or processes to support multiple roles across defence and security.

To keep our courses relevant and up-to-date, modules are subject to change. Modules typically form 60% of the course content, with the project or thesis making up the other 40% (see page 5). The information in this brochure regarding the number of modules required applies to the MSc. Please see the website for the PgCert or PgDip requirements and further module details.

**Cyber Defence and Information Assurance**
(part-time, accredited – see page 25)

Designed to develop professionals who can lead in a cyber environment, this course focuses on understanding and articulating the executive-level responses to serious present and emerging threats in the information domain.

**Compulsory modules**
- Applied Cyber Concepts Project,
- Critical Networks and Process Control,
- Cyber Attack – Threats and Opportunities,
- Cyber Systems Thinking and Practice,
- Foundations: Management of Cyber,
- Incident Management,
- Research Methods,
- Social Technologies,
- The Human Dimension,
- Understanding Risk.

**Elective modules (choose one)**
- Data-led Decision Support,
- Emerging Technology Monitoring.

**Cyberspace Operations**
(part-time only)

The Cyberspace Operations MSc is designed to develop professionals to support manoeuvres in cyberspace, in contested operations and as part of integrated planning.

**Compulsory modules**
- Cyber Attack – Threats and Opportunities,
- Cyber Systems Thinking and Practice,
- Cyberwarfare in Intelligence and Military Operations,
- Foundations: Management of Cyber,
- Incident Management,
- Research Methods,
- Social Technologies,
- Understanding Risk.

**Elective modules (select 30 credits)**
Choose 20 credits from the following modules:
- The Human Dimension (10 credits),
- Critical Networks and Process Control (10 credits),
- Applied Cyber Concepts Project (20 credits).

Choose 10 credits from the following modules:
- Data-led Decision Support (10 credits),
- Emerging Technology Monitoring (10 credits).
Defence and Security (Technology) (part-time only)

Collectively known as the Defence and Security Programme, the different MSc routes allow you to customise your degree and build your skills in technology disciplines within the defence and security sector. Choose a route to suit your individual learning pathway. Read more about the Defence and Security Programme, including the different course structure, on pages 16-21.

**MSc route:** Choose selected modules from a variety of defence and security courses in the technology stream, and some from across all the streams, to suit your specific area of interest, broadening or deepening your knowledge.

**MSc capstone route:** Perfect for those who would like to apply their learning directly to their work, the capstone portfolio emphasises business application and innovation to enable you to tailor your learning specifically around your topic. This route combines an equal percentage of taught and research. You will undertake 200 credits, with 100 credits in the taught phase and 100 credits within the portfolio phase.

Information Capability Management (accredited – see page 25)

This course focuses on the value of information and the principles and practice that underlie secure, effective and efficient business systems that exploit information in order to provide business benefit.

**Compulsory modules**
- Cyber Security and Information Assurance,
- Data-led Decision Support,
- Data Modelling, Storage and Management,
- Digital Business Strategy,
- Emerging Technology Monitoring,
- Foundations of Information Systems,

**Compulsory modules**
- Methods and Tools for Information Systems Development,
- Organisational Development,
- Professional Issues,
- Programme and Project Management for Information Systems,
- Software Engineering,
- Systems Architecture.
Military Operational Research  
(MSc, PgDip, PgCert)

Operational research plays an important role in supporting a broad range of decision-making in the military environment. You will examine the context, issues and methods used to analyse the increasingly complex challenges in the defence environment, and to support decision making.

**Compulsory modules**
- Introduction to Operational Research Techniques,
- Decision Analysis,
- Discrete and Continuous Simulation,
- Intelligent Systems,
- Logistics Modelling,
- Statistical Analysis and Trials,
- War Gaming and Combat Modelling,
- Weapon System Performance Assessment.

**Elective modules**
Select five from the following modules:
- Availability, Reliability, Maintainability and Support Strategy,
- Decision Analysis, Modelling and Support,
- Human Centric Systems Engineering,
- Model Based Systems Engineering,
- Networked and Distributed Simulation,
- Systems of Systems Engineering,
- Simulation and Synthetic Environments,
- Systems Engineering and Software,
- Systems Engineering Workshop.

Select two from the following modules:
- The International Dimensions of Defence Acquisition,
- Knowledge in Defence,
- Programme and Project Management,
- Supply Network Management in Defence and Commercial Environment.

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Systems Engineering for Defence Capability  
(accredited – see page 25)

In a rapidly changing world, our systems engineering course will equip you to deal with complex challenges. It provides a comprehensive coverage of modern systems engineering principles, practices, methods and tools, placing great emphasis on their practical application.

**Compulsory modules**
- Advanced Systems Engineering Workshop,
- Applied Systems Thinking,
- Capability Context,
- Lifecycle Processes – Advanced,
- Lifecycle Processes – Introduction,
- Systems Approach to Engineering.

**Elective modules**
Select five from the following modules:
- Availability, Reliability, Maintainability and Support Strategy,
- Decision Analysis, Modelling and Support,
- Human Centric Systems Engineering,
- Model Based Systems Engineering,
- Networked and Distributed Simulation,
- Systems of Systems Engineering,
- Simulation and Synthetic Environments,
- Systems Engineering and Software,
- Systems Engineering Workshop.

Select two from the following modules:
- The International Dimensions of Defence Acquisition,
- Knowledge in Defence,
- Programme and Project Management,
- Supply Network Management in Defence and Commercial Environment.

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“My employer has funded my course and they provide time off to complete the taught phase of the course. This has enabled me to spread out my learning over a few years, allowing me to react to times of high workload in the workplace and adjust to changes in my personal life, whilst still enjoying a work-life balance.”

Christian Simons,  
(Systems Engineering for Defence Capability PgDip 2018)
Brand new for 2019, the Defence and Security Programme offers three degree streams in Engineering, Technology and Leadership and Management, to provide blended, flexible education suitable for a range of learners engaged in the complex, evolving defence and security environment. The concept enables tailored learning routes with extensive elective choices to meet the demands of learners across their career as well as meeting varying employer requirements.

Who is this for?
Aimed at recent graduates and experienced or qualified engineers, scientists, managers or leaders, this course is perfect for anyone wishing to further their skills or apply them in new areas within the defence and security sector. It enables you to determine your own learning agenda, rather than following a set course curriculum, and its approach allows you to customise your learning directly to your work or interest.

Length of study
The programme is offered part-time. Typical completion for the MSc is three years, with two years for the PgDip or PgCert.

Delivery method
Delivered through a combination of face-to-face, distance and blended modules, the programme provides maximum flexibility to the learner. The high proportion of distance learning makes it ideal for those with demanding careers.

More details are available on our website. See www.cranfield.ac.uk/defenceandsecurityprogramme
Subject streams

All streams have common core modules providing essential professional competencies (see programme structure overleaf). Through the broad choice of elective modules, each stream further provides depth in specialist topics aligned with their relevant range of disciplines.

You can centre your learning around these three subject streams – choose from the extensive list of elective modules on pages 20 and 21.

More details are available on our website. See www.cranfield.ac.uk/defenceandsecurityprogramme
The Defence and Security Programme

Course structure

Once you have decided on your subject stream, you have two routes to choose from to further customise your learning pathway.

**MSc route**  200 credits

The Defence and Security MSc in engineering, leadership and management or technology consists of five core modules with seven electives from an extensive module list (see overleaf) and is completed with a thesis on a subject of your choice.

<table>
<thead>
<tr>
<th>Course</th>
<th>Compulsory modules</th>
<th>Elective modules</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PgCert</strong></td>
<td>60 credits</td>
<td>Two stream specific modules from the table overleaf. 20 credits</td>
</tr>
<tr>
<td><strong>PgDip</strong></td>
<td>60 credits</td>
<td>Three stream specific modules from the table overleaf. 30 credits</td>
</tr>
<tr>
<td><strong>MSc</strong></td>
<td>80 credits</td>
<td>Two additional modules from any of the streams on the tables overleaf 20 credits</td>
</tr>
</tbody>
</table>

**Compulsory modules**

- Introduction to Defence and Security 10 credits
- Leadership and Management 10 credits
- Stakeholder Management and Organisational Behaviour 10 credits
- Decision Analysis and Support 10 credits

**Elective modules** (each worth 10 credits)

- PgCert
- PgDip
- MSc

18 credits

10 credits

30 credits

20 credits

18
**MSc capstone route**  

200 credits

The Defence and Security MSc in engineering, leadership and management or technology capstone route has a high proportion of distance learning. You will develop a portfolio focused on business application and innovation, enabling you to combine your learning directly with a work project.

<table>
<thead>
<tr>
<th><strong>PgCert</strong></th>
<th>60 credits</th>
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</thead>
<tbody>
<tr>
<td><strong>Compulsory modules</strong></td>
<td></td>
</tr>
<tr>
<td>Introduction to Defence and Security</td>
<td>10 credits</td>
</tr>
<tr>
<td>Leadership and Management</td>
<td>10 credits</td>
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<tr>
<td>Stakeholder Management and Organisational Behaviour</td>
<td>10 credits</td>
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<tr>
<td>Decision Analysis and Support</td>
<td>10 credits</td>
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<table>
<thead>
<tr>
<th><strong>MSc</strong></th>
<th>140 credits</th>
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<tbody>
<tr>
<td>Capstone Development and Exploitation</td>
<td>40 credits</td>
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<tr>
<td>Capstone Portfolio</td>
<td>100 credits</td>
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</tbody>
</table>

**Elective modules** (each worth 10 credits)

Two stream specific modules from the table overleaf.

20 credits
The Defence and Security Programme

Elective modules

Customise your degree using these tables, following the course structure you have selected on the previous page.

**Leadership and Management**

<table>
<thead>
<tr>
<th>Elective modules</th>
<th>Related course</th>
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<tbody>
<tr>
<td>• Commercial Relationships in the Defence Environment</td>
<td>• Defence Acquisition Management (see page 10)</td>
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<tr>
<td>• Cost Estimating and Planning</td>
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<tr>
<td>• Effective and Efficient Through Life Support</td>
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<tr>
<td>• International Dimensions of Defence Acquisition</td>
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<td>• Knowledge in Defence</td>
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<tr>
<td>• Programme and Project Management</td>
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<tr>
<td>• Strategic Management and Introduction to Acquisition</td>
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<tr>
<td>• Supply Network Management in Defence and Commercial Environment</td>
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<tr>
<td>• Sustainability in Defence</td>
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<tr>
<td>• Defence and Security Offset</td>
<td>• Defence and Security Export (see page 10)</td>
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<tr>
<td>• Legal Ethical and Political Frameworks for Defence Negotiation</td>
<td></td>
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<tr>
<td>• Defence Sector and Organisational Behaviour</td>
<td>• Defence Leadership (see page 11)</td>
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<tr>
<td>• Global Security; Culture and Complexity</td>
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<tr>
<td>• Global Security; Emerging Challenges</td>
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<tr>
<td>• Leadership Studies – Classical and Modern</td>
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<tr>
<td>• National Security: Resilience and Crisis</td>
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<tr>
<td>• Programme and Project Management</td>
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<td>• Psychology of Leadership</td>
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<td>• Strategic Management in Defence</td>
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<td>• Counter Terrorism and Intelligence</td>
<td>• Defence and Security Programme</td>
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<td>• Defence in the 21st Century</td>
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<tr>
<td>• Future Military Conflict and Support to Disasters</td>
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<tr>
<td>• Managing Defence in the Wider Security Context</td>
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<tr>
<td>• Risk, Crisis and Resilience</td>
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</table>
### Engineering

<table>
<thead>
<tr>
<th>Elective modules</th>
<th>Related course</th>
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| • Fires, Explosions and their Investigations  
• Forensics Investigation of Explosives and Explosive Devices  
• Introduction to Firearms Investigations and Forensic Ballistics | • Forensic MSc Programme  
(see www.cranfield.ac.uk/cfi) |
| • Element Design  
• Fundamentals of Ballistics  
• Military Vehicle Propulsion and Dynamics  
• Modelling Simulation and Control  
• Reliability and Systems Effectiveness  
• Survivability  
• Vehicle Systems Integration  
• Weapon Systems Technology | • Gun System Design (see page 7)  
• Military Vehicle Technology (see page 8) |
| • Aviation Safety Management  
• Introduction to Human Factors  
• Mechanical Integrity of Gas Turbines  
• Military Aircraft Systems  
• Practical Reliability  
• Guided Weapons | • Military Aerospace and Airworthiness (see page 7)  
• Military Vehicle Technology (see page 8) |
| • Avionics | |

### Technology

<table>
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<tr>
<th>Elective modules</th>
<th>Related course</th>
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| • Foundations: Management of Cyber  
• Social Technologies  
• The Human Dimension | • Cyber Defence and Information Assurance  
(see page 12)  
• Cyberspace Operations (see page 12) |
| • Data-led Decision Support | • Cyber Defence and Information Assurance  
(see page 12)  
• Cyberspace Operations (see page 12)  
• Information Capability Management (page 13) |
| • Computer Graphics  
• Foundations of Modelling and Simulation | • Defence Simulation Modelling (see page 15) |
| • Intelligent Systems  
• War Gaming and Combat Modelling | • Defence Simulation Modelling (see page 13)  
• Military Operational Research (see page 13) |
| • Digital Crime and Investigation | • Forensic MSc Programme  
(see webpages) |
| • Emerging Technology Monitoring  
• Methods and Tools for Information Systems  
• Organisational Development  
• Programme and Project Management for Information Systems  
• Software Engineering | • Information Capability Management (see page 21) |
| • Introduction to Operational Research Techniques  
• Logistics Modelling  
• Statistical Analysis and Trials | • Military Operational Research (see page 21) |
| • Applied Systems Thinking  
• Lifecycle Processes Introduction  
• Systems Approach to Engineering  
• Systems Engineering Workshop | • Systems Engineering for Defence Capability  
(see page 14) |
MBA Defence

Created specifically for the defence community, the MBA Defence programme has been developed out of a growing interest both within the UK defence sector and the international defence community for management education. The programme allows you to improve your skills and techniques in general management, and build the confidence, emotional intelligence, decision-making and team-working qualities that make for inspirational leaders. The course is offered in partnership with Cranfield Defence and Security at the Defence Academy, Shrivenham and the School of Management at Cranfield. Moreover, as part of the course, you will be given the opportunity to place your learning in the context of a global perspective by visiting a foreign country and within it a number of organisations.

For more information please see: www.cranfield.ac.uk/som/mbadefence

Cranfield School of Management

The MBA Defence is delivered with the Cranfield School of Management which is one of an elite group of business schools worldwide to hold the triple accreditations from the Association to Advance Collegiate Schools of Business (AACSB), the Association of Master of Business Administration (AMBA) and the European Quality Improvement System (EQUIS).
MSc by Research in Defence and Security

This is a structured programme of research involving a review of literature, collection and analysis of data and presentation of the results in a thesis. The thesis is required to demonstrate a higher academic standard than the taught MSc thesis in terms of originality, innovative features, depth of analysis or a combination of all these factors. It is not as complex as a PhD research programme, which is typically undertaken over a three-year study period. The subject area can be any area related to the defence and security sector and agreed in consultation with the master’s research supervisor.

PhD in Defence and Security

Completion of a PhD involves original research work which results in either developing entirely new areas of study, or is concerned with the application of novel and existing ideas in new ways and new fields of activity. A programme of support and a dedicated supervisor, together with research training programmes, are provided to help you achieve your PhD. Our flexible approach to studying at Cranfield allows you to carry out part of your research away from the University, whether it is overseas, or you need to undertake extensive local fieldwork to research a problem of local relevance. The qualification can be completed in three years full-time, or six years part-time.
**Key facts and statistics**

### Course information

- **Full-time**
  - One year

- **Part-time**
  - Up to three years
  - See the course page for more information about part-time study.

- **Start date**
  - Different courses have different start dates throughout the year. Please see the individual course page for details.

- **MSc/PgDip/PgCert**
  - Not all courses offer all awards, see course information pages for details of awards offered.

- **Fees**
  - Please see the individual course pages on our website for full fee information and full-time or part-time options. Terms and conditions apply.

See [www.cranfield.ac.uk/fee-information](http://www.cranfield.ac.uk/fee-information)

### Accreditations

#### Engineering

Our Explosive Ordnance Engineering MSc is accredited by the Institution of Mechanical Engineers (IMechE) and the Institution of Engineering and Technology (IET). Guided Weapon Systems MSc and Military Aerospace and Airworthiness MSc are both Engineering Council accredited degrees. Military Aerospace and Airworthiness is also accredited by the Royal Aeronautical Society.

#### Leadership and Management

Our Defence Acquisition Management MSc is accredited by the Chartered Institute of Procurement and Supply (CIPS), the Chartered Institute of Logistics and Transport (CILT), and we are an Approved Centre for the Chartered Management Institute (CMI). The Defence Leadership MSc is accredited at the Level 7 award in Strategic Leadership by the Institute of Leadership and Management (ILM).

#### Technology

The Cyber Defence and Information Assurance MSc is supported by the UK government's Cabinet Office and the Office of Cyber Security and Information Security. The Information Capability Management MSc is accredited by the British Computer Society (BCS) and the Chartered Institute of Library and Information Professionals. The Systems Engineering for Defence Capability MSc is accredited by the Institution of Engineering and Technology (IET) and the Institution of Mechanical Engineers (IMechE).

*These figures give an indication of the course make-up at registration across Defence and Security for 2017-2018.
Careers

The applied and practical research you will do on your course will ensure that you will be valued by a wide variety of organisations across the world. Successful graduates can expect to go on to a wide range of careers as professional scientists or engineers in the defence and security sector, in roles across the full breadth of industrial and public sector organisations.

Organisations

• AWE,
• BAE Systems,
• QinetiQ,
• Rolls-Royce,
• BMT Hi-Q Sigma,
• Royal Engineers (RE).

Roles

• Production Manager,
• Information Systems Technician,
• Senior Security Officer,
• Engineering Technician,
• Strategic Planner,
• Systems Developer.

Open days

We hold open days at both our Cranfield campus and Cranfield University at Shrivenham. These offer you the opportunity to spend time with us to experience Cranfield’s unique atmosphere and culture.

Recruitment fairs

We regularly attend recruitment events worldwide. These offer you the opportunity to meet some of our academics and admissions team in a city near you.

To view our events calendar please visit: www.cranfield.ac.uk/events
Industry links

Cranfield has unrivalled links with industry and military organisations worldwide. You will benefit from our extensive contacts and track record of close collaboration with the defence and security sector.

Cranfield University is partnering with Purdue University in the United States to offer a suite of graduate-level education programmes for the US Department of Defense (DOD).

The first offering will be a dual master’s degree in Defence Engineering and Technology with a specialisation in expeditionary warfare – the deployment of a country’s military forces to fight abroad.

Further educational programmes are being developed, which will enable military personnel and civilians in the scientific, engineering and technology communities affiliated with the DOD to study for degrees in defence engineering.

A number of our students who are sponsored by their employer take the opportunity to complete an MSc thesis directly linked to their business needs. This has benefits for both the student and their employer. The Atomic Weapons Establishment (AWE), BAE Systems, UK Ministry of Defence and the US Department of Defence have all supported past student theses.

Academics at Cranfield Defence and Security have also worked and collaborated with a number of prestigious, clients such as BP, the United Nations, and the United States Institute for Peace.

Examples of the organisations we work with
Academic staff

You will be taught by a wide range of subject specialists, drawn from the University staff and supported by industry professionals, who bring their research and industrial expertise to provide stimulating and informed input to your learning experience.

Professor Jackie Akhavan, Head of Centre for Defence Chemistry
Jackie graduated from the University of Southampton with a BSc (Hons), MPhil and PhD in chemistry. She joined Cranfield University as a lecturer in polymer chemistry and soon afterwards established her research group in polymer bonded explosives. She is a Fellow of the Royal Society of Chemistry, a Chartered Chemist, a Fellow of the Institute of Explosive Engineers and a member of the Board of Trustees for the Explosives Engineers Educational and Research Trust.

Professor Laura Cleary, Head of Centre for International Security and Resilience
Laura Cleary holds a BA in Political Science and History from Indiana University and a PhD on Soviet Defence Conversion from the University of Glasgow. Prior to joining Cranfield in 2002, she lectured in International Politics at the University of Stirling and in Comparative Politics at the University of Glasgow and Glasgow Caledonian University. The quality of her teaching has been recognised through the award of the PSA's Bernard Crick Prize for new lecturers in 1997, and the Cranfield Defence and Security Award for Teaching Excellence in 2010.

Professor Ann Fitz-Gerald, Head of Centre for Defence Management and Leadership
Professor Ann Fitz-Gerald obtained two degrees in both Commerce and Politics from Queen's University, Canada, as well as a Master of Arts in War Studies from the Royal Military College of Canada and a PhD from Cranfield University. Through her academic qualifications and professional experience, Ann brings both a political science and management science 'lens' to the study of contemporary security challenges, and her research includes issues in peacebuilding, the development of national security strategies, and the reform of national security sectors.

Professor Amer Hameed, Head of Centre for Defence Engineering
Professor Amer Hameed obtained a BSc (Honours) degree in Mechanical Engineering from the University of Engineering and Technology, as well as an MSc in Gun System Design and a PhD in Gun Barrel Design Optimisation from Cranfield University. Amer has an international reputation as a researcher and supervisor, with a number of significant pedagogical contributions. He has also proved successful and dynamic in winning new business.

Dr David James, Head of Centre for Electronic Warfare, Information and Cyber
Prior to joining the Defence Academy, David spent eighteen years at Dstl (part of UK Ministry of Defence) working in the areas of electro-optics, non-linear optics and laser threats gaining a PhD in non-linear optical materials and devices (from Cranfield University). David's specialisation is in the field of electro-optics and lasers, particular laser directed-enemy weapon (DEW) for the defeat of sensors and he has lead on the assessment of several foreign threat laser systems. He has written classified papers on these subjects and has acted as a consultant and defence analyst to the UK Ministry of Defence. David has been an invited speaker at Symposia at Shrivenham events, as well as other conferences, on laser threat evaluation and laser applications.
Professor Emma Sparks, Head of Centre for Systems Engineering
Before joining Cranfield University at Shrivenham, Emma worked for five years as a research scientist. During this time, she was responsible for numerous projects looking at all aspects of human protection and performance. Emma has BSc (Hons) in Sports Science and Osteopathy, as well as an MSc and PhD in Systems Engineering for Defence.

Mr Jeremy D Smith, Head of Centre for Simulation and Analytics
Responsible for developing and delivering lectures for a broad range of courses, Jeremy has taught full-time MScs as well as short courses, on- and off-site. Jeremy has done research and consultancy in systems engineering, weapon system and vehicle assessment, training needs analysis, human factors and operational analysis. He has consultancy experience across the complete project lifecycle from analysis and evaluation, planning and implementation and delivery. Jeremy has also worked with leading clients such as Dstl and BAE Systems.

Mr Stuart Young, Head of Centre for Defence Acquisition
Since joining Cranfield University in 2008, Stuart has been responsible for the development and delivery of courses aligned to the education needs in defence acquisition activities in the United Kingdom. He is also actively involved with advising a number of governments on the development of defence industrial policy and strategy. Stuart is an expert facilitator and has led workshops in various organisations in support of change initiatives within the UK Ministry of Defence.
Financing your studies

The Apprenticeship Levy

The Apprenticeship Levy is a levy on UK employers with a pay bill of more than £3 million. An organisation can use its levy to fund apprenticeship training against approved apprenticeship standards.

These standards are developed by industry-led Trailblazer Groups and are based on occupational competence, and the knowledge, skills and behaviours of particular roles. The standards combine on-the-job experience, and off-the-job training with an academic qualification. Your organisation may use its levy funds to sponsor UK employees on a course that is mapped to one of the standards. Our Systems Engineering Master’s Apprenticeship MSc fulfils the needs of the Level 7 Systems Engineering Standard. Our Defence and Security Programme courses are currently being mapped to a relevant standard so it may soon also be possible to fund these via the Apprenticeship Levy.

Please read more on www.cranfield.ac.uk/masterships

Salary sacrifice

The use of salary sacrifice in the UK can help you and your employers reduce the net cost of paying for work-related study.

Your organisation enters into an agreement to fund your study, with you agreeing to a reduction in your salary for a defined period corresponding to an agreed portion of the course fees. Training fees are often tax deductible for organisations as well.

If you are not being sponsored by your employer or through the Apprenticeship Levy, we can provide information and a range of online tools to help you put together the funding package you need for your course and living costs.

There is more information on our website: www.cranfield.ac.uk/funding

How to apply

Read more about our entry requirements and how to apply on our website.

www.cranfield.ac.uk/apply
Life at Cranfield

Cranfield University at Shrivenham

Cranfield University at Shrivenham is located at the Defence Academy, which is a secure Ministry of Defence (MOD) site. It is situated in beautiful countryside near Swindon, with quick and convenient links to London and major UK airports.

Cranfield Campus

Located just over an hour from London in the English countryside, Cranfield’s campus environment supports close, working relationships between our multinational postgraduate students and academic and industry experts.

Important information about security clearance for courses that are held in full or part at Shrivenham

Some Cranfield University courses are delivered at the Defence Academy of the United Kingdom, Shrivenham which is a Ministry of Defence (MOD) site. All applicants to courses that are wholly or partially delivered at Shrivenham must complete the BPSS (HMG Baseline Personnel Security Standard V4 April 2014) prior to registration on the course or must already hold a security clearance to this level or higher. It will take additional time to process your BPSS clearance application and you will not be able to do this course if you fail to obtain this. Please refer to the course page on the website for full details.

Take a virtual tour to see inside some of our facilities:

virtualtour.cranfield.ac.uk
Cranfield University works with over 1,500 businesses and governments based in over 40 countries.

These organisations include:

- AIRBUS
- AWE
- BAE SYSTEMS
- dstl
- EPSRC
- Ford
- LEONARDO
- LOCKHEED MARTIN
- MBDA
- POOL RE
- THALES

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www.cranfield.ac.uk/defenceandsecurity

For a full list of Cranfield University courses, please see the prospectus.

Every effort is made to ensure that the information in this brochure is correct at the time it is printed. Please check our website for the latest information.

CDS March 2019