

Division & Division & Capability Area	Location(s)	Title	Description	Aerospace/ Aeronautical Engineering, Naval Architecture	Chemical, Radiological, Biological, Food sciences	Computer Sciences, IT, Software Engineering, Telecommunications	Electronic/ Electrical Engineering	Materials Science	Mathematics and physics	Mechanical and Mechatronic Engineering (including robotics)	Psychology and Social Sciences	Desirable Skills
Weapons Systems Technology	Edinburgh (SA)	FPGA 101 with MATLAB and Simulink	This project aims to develop a passive radar by programming an FPGA using MATLAB and Simulink.									<ul style="list-style-type: none"> General software development skills (basic MATLAB and Simulink). Basic Linux skills would be desirable.
Weapons Systems Technology	Edinburgh (SA)	RF shielding for VHF and UHF	RF shielding is an integral component in the design of systems which emit RF radiation. This project will require the student to examine RF shielding, through a literature review, and report on shielding effectiveness of materials. The purpose is to understand what shielding materials are available to shield against RF emissions in the 200 MHz to 5 GHz range.									<ul style="list-style-type: none"> Physics and mathematics understanding Ability to write a report Utilise Matlab for simulation work.
Distributed Combat & Mission Systems	Edinburgh (SA)	Tactical Decision Modelling Test-bed	This project will provide real-world software engineering experience, undertaking development and enhancement of an existing suite of scientific research simulation software used to support research in decision making within distributed human and autonomous (AI) tactical systems. You will gain experience with software development practices including CM and Agile, covering all aspects of the software development process from requirements and development through to test and release.									<ul style="list-style-type: none"> Software & Systems Engineering Requirements development Software interface design Software Design principals and Design Patterns Software Configuration Management Software Documentation Team-based work environment.
Distributed Combat & Mission Systems	Edinburgh (SA)	Decision Modelling Architecture	This project will provide a unique opportunity to develop skills on decision science, modelling, and the control of future AI systems. The objective is to identify and demonstrate one or more decision structures that support the effective human command and control of a swarm of drones to achieve a mission objective. The approach will involve a literature review to identify current approaches to the control of swarms, identification of the roles and control mechanisms, and the development of a simulation to demonstrate the concept.									<ul style="list-style-type: none"> Software & Systems Engineering Requirements development Software interface design Software Design principals and Design Patterns Software Configuration Management Software Documentation Team-based work environment.
Distributed Combat & Mission Systems	Edinburgh (SA)	Demonstration of a Decision Structure for swarming autonomous systems	This project will provide a unique opportunity to develop skills on decision science, modelling, and the control of future AI systems. The objective is to identify and demonstrate one or more decision structures that support the effective human command and control of a swarm of drones to achieve a mission objective. The approach will involve a literature review to identify current approaches to the control of swarms, identification of the roles and control mechanisms, and the development of a simulation to demonstrate the concept.									<ul style="list-style-type: none"> Computer Science, Mathematical Modelling and Data Science. Team-based work environment.

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Distributed Combat & Mission Systems	Edinburgh (SA)	Complex battlespace visualisation.	Work closely with researchers to develop concepts to clearly and dramatically represent the physical and cyber interaction between advanced defence platforms in a complex, modern battlespace.									<ul style="list-style-type: none"> 3D modelling and timeline-based modelling Narrative story development War-game development Visual arts.
Integrated Combat Capability Assessment	Edinburgh (SA)	Future Tactical Management System	A Combat Management System (CMS) is the software operating within military vehicles such as ships, planes, and tanks that enables military personnel to defend themselves and others against hostile intent. The Future Tactical Management System (fTMS) is a distributed, software-based research platform, backed by constructive and virtual simulation, which enables novel CMS functionality to be analysed and experienced. This project requires the development of software components for integration into the fTMS. These software components may represent core and new CMS functionality (including User Interface components), simulation capabilities, and infrastructural elements to make the whole system easier for people to use.									<ul style="list-style-type: none"> Software development experience including version control, issue tracking, and, ideally, knowledge of one of C++, Java, or JavaScript. Good communication skills. Ability to work in teams. Experience with modelling and simulation a plus.
Integrated Combat Capability Assessment	Edinburgh (SA)	Agent based modelling for analysis of a Counter UAS Laser-DEW system	The project aims to assess the performance of a future Laser-Directed Energy Weapons based Counter-Unmanned Aerial System (C-UAS) weapon system using an Agent Based Model of the weapon and (swarming) threat systems.									<ul style="list-style-type: none"> Statistics Design of Experiments Analysis & Computer Programming (Agent Based Models) Modelling and analysis
Cyber Assurance and Operations	Edinburgh (SA)	Adversarial Machine Learning in Social Media Bot Detection	Many Australians are increasingly using social media platforms as a primary source of news and information. A threat model can be conceived in which malicious state actors sway public opinion by manipulating the messages that appear on social media. The main objective of this project is to explore the domain area of social media bot detection to determine the susceptibility of deployed machine learning models to adversarial machine learning techniques. The secondary objective of this project is to develop defence measures to improve social media bot detection technologies.									<ul style="list-style-type: none"> Strong coding experience in Python. Knowledge of machine learning techniques, particularly in classification algorithms.
Cyber Assurance and Operations	Edinburgh (SA)	Automated Cyber Red-Teaming	The successful student will contribute to the Cyber Red-Teaming research and development activities within the Cyberwarfare and Operations Branch through one of the following projects: <ul style="list-style-type: none"> Data visualisation / UX: Create an interface which allows an operator to understand a complex system, its attack surfaces, and vulnerabilities. Systems / Scripting: Create a set of scripts and/or extensions to existing tools which assist in the automated enumeration of a given system. This may include users / services and cross-referencing for known exploits and vulnerabilities. 									<ul style="list-style-type: none"> General software development skills, scripting, source control configuration management Good communication skills, Ability to work in teams Motivated and goal-focussed

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Cyber Assurance and Operations	Edinburgh (SA)	Visualisation of Military Cyber Terrain	People process information more rapidly when it is presented visually. Visualisation also helps users to gain additional insight into their data by highlighting dependencies and enabling the speedy detection of patterns and anomalies. In the military context, commanders need to know how their mission objectives rely upon the cyber environment. This knowledge is crucial for aiding situational awareness, positioning defensive measures, and understanding the ability to fight-through in the event of degraded networks and cyber resources. In this project, you will design, build and evaluate approaches and software to visualise cyber entities and their dependencies.									<ul style="list-style-type: none"> Coding experience Knowledge of visual design
Cyber Assurance and Operations	Edinburgh (SA)	Discovering human workflows from network packet capture through machine learning and agent simulation	The Australian military depends upon computer networks that handle immense amounts of information flow. These information flows are a rich data source, from which we may be able to infer organisational process, the relationships between military functions, the relationships between users, roles and missions, and the dependency of missions on cyber assets. Such analytics have the potential to provide military commanders with critical situational awareness. For generality across a wide range of defence applications, it is desirable to derive these analytics from raw network traffic where possible. In this project you will investigate how, and to what extent, user and group behaviour, characteristics and workflows can be inferred by analysing captured packet data using automated statistical and machine learning methods.									<ul style="list-style-type: none"> Experience or interest in software development and scripting, Experience or interest in setting up or administering computer networks, Knowledge or interest in statistical and machine learning data analysis methods
Cyber Assurance and Operations	Edinburgh (SA)	Autonomous Agents for Cyber Defence	Autonomous agents are increasingly capable of performing tasks traditionally performed only by humans. The Autonomous Cyber Operations team seeks to apply various automation techniques to assist with cyber defence. The student will help the team implement and test automation algorithms across a variety of cyber scenarios.									<ul style="list-style-type: none"> Strong mathematical background Python programming experience desirable Machine learning experience desirable
Cyber Assurance and Operations	Brisbane (QLD)	Information-flow logics for detecting hardware-related security vulnerabilities	Modern multicore processors include a range of optimisations to speed up the execution of code. Since 2018, there has been a high rate of discovery of security vulnerabilities due to such hardware optimisations (e.g., Spectre, Meltdown, Foreshadow, Spoiler, ZombieLoad). In this project, you will adapt an existing information-flow logic for detecting such vulnerabilities for use with specific intermediate representations of code used by state-of-the-art analysis tools.									<ul style="list-style-type: none"> Strong maths skills, particularly in discrete maths. Excellent communications skills, and the ability to work both in a team, and independently.
Contested Communications	Edinburgh (SA)	Machine learning based detection and classification of drones flying beyond line-of-sight	In the past few years, commercial drones have gained immense popularity due to their low cost and ease of use. Commercial drones have been used successfully in many applications such as remote sensing and surveillance, search and rescue missions, package deliveries and aerial photography. Notwithstanding their huge commercial success, drones are becoming a growing threat to both civilian and military sectors. Commercial drones are usually operated via radio signals exchanged between the drone and a ground controller. This student project will focus on developing a machine learning based framework to detect and classify commercial drones at a distance using the radio frequency (RF) signals transmitted from these platforms. The main tasks for this project include capturing RF signals from multiple commercially available drones, extracting useful features from the captured signals, using these extracted features to train a suitable machine learning algorithm (such as a Convolutional Neural Network) and investigating its performance.									<ul style="list-style-type: none"> Prior experience of data analysis using MATLAB An interest to explore different machine learning techniques Some knowledge of communication theory and signal processing techniques Good written and verbal communication skills

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Contested Communications	Edinburgh (SA)	SDR based Doppler frequency offset tracking and pre-compensation for military satellite communications	Doppler frequency shifts arise due to relative distance changes between a moving terminal and the satellite and there are other instability caused frequency drifts. In certain SATCOM scenarios, it will be difficult to efficiently design the receiver to cope with large Doppler frequency offsets and higher order variations. This student project will focus on researching the techniques to implement Doppler tracking and pre-compensation algorithms in real-time using an USRP (Universal Software Radio Peripheral) SDR (Software Defined Radio) platform. Previous channel measurement data are available, so initial design and development can be focussed in the laboratory using satellite link emulator.									<ul style="list-style-type: none"> • Prior programming experience using Matlab and/or any SDR developmental platform • Some knowledge of satellite communication systems and communication signal processing theory • Good written, communication and computer skills
Electronic Warfare Operations	Edinburgh (SA)	Embedded Controller Selection	This project will develop an automated web scraping tool and associated database in order to analyse and collate different embedded processors to determine best fit for future projects									<ul style="list-style-type: none"> • Experience in python • Experience in databases (sql preferred) • Experience in electronics (helpful, not required) • General scripting/software development practices highly desirable
Electronic Warfare Operations	Edinburgh (SA)	UV Sky simulation	This project will involve using an ultraviolet camera to take radiometric sample images of the sky under different conditions (time of day, humidity, UV rating). From these images a simple mathematical model of a 'blue' sky in the ultraviolet will be developed in conjunction with a defence scientist. A simple computational program (in MATLAB) will need to be written to aid analysing the UV sky images. Once a model is developed, a basic program to produce virtual sky images based on input parameters of the type of sky desired to be simulated (direction, time, location etc.) is required to be produced. If time permits the student can try to simulate clouds in their virtual sky program.									<ul style="list-style-type: none"> • Willingness to work outside when taking measurements • Very basic MATLAB skills for data analysis, mathematical model calculations and visualisation/plotting of results which will form the UV sky simulation • 2nd year university level physics and mathematics for determining a mathematical model.
Electronic Warfare Operations	Edinburgh (SA)	Intelligent Radar Testbed	The aim of this project is to enhance a DST-built radar development testbed designed to adaptively interact with complex electromagnetic environments. This research will investigate the implementation of traditional radar processing techniques and explore novel modern machine learning approaches. Radar development will be performed on highly adaptive & programmable software-defined-radio hardware.									<ul style="list-style-type: none"> • Software development skills (MATLAB, Python, GNU Radio and/or LabView), including visualisation, signal processing, and implementing machine learning techniques • Good experimental skills including using test equipment to perform RF testing and debugging of RF hardware. • Excellent written communication skills and the ability to work as part of a team.

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Electronic Warfare Operations	Edinburgh (SA)	Cognitive Radar Perception	The aim of this project is to develop a machine-learning software toolset capable of replacing human operators and legacy radar processing techniques. The tool set will enable a computer to intelligently interpret a radar display to perform autonomous behaviour monitoring and anomaly detection. This project will offer opportunities to explore modern machine learning techniques such as deep learning to implement leading-edge radar processing algorithms.									<p>Interest, experience & skill in most or all of the following:</p> <ul style="list-style-type: none"> • Software development (particularly in MATLAB, python and/or C++), performing experiment • Data visualisation, numerical modelling, signal processing, machine learning • Can demonstrate exceptional computer-based, verbal and written communication skills. • This research may also involve GPGPU computing.
Electronic Warfare Operations	Edinburgh (SA)	Effectiveness of deep learning models for multi-class object detection in visible and infrared videos	This project will focus on training, assessing and comparing a number of modern detectors on visible and infrared data sets. In particular, object classes of interest will include but not limited to aircraft, ships, tanks, UAVs, people, dogs, bicycles, motorbikes, cars, trucks, birds, clouds, trees and bridges. Some of these categories will be sub-divided into civilian and military classes for fine-grained classification. The project will rely on existing large databases as well as data sets supplied by DST to perform model training. The successful candidate will work as part of a team to develop and apply deep learning detectors to real-life scenarios and gain insight of how research can be transitioned into practical systems. The trained models will be integrated into DST software as a final stage to the project.									<ul style="list-style-type: none"> • Knowledge in Matlab, Python and C/C++ is desirable
Non-Acoustic Signature Management	Fishermans Bend (VIC)	New Zodiac Design	Develop a preliminary design for next generation inflatable rubber craft which addresses the limitations posed by the current design									<ul style="list-style-type: none"> • Design experience, Interest in powered transportation or motorsport (batteries, electric motors or combustion engines) • Experience with SolidWorks or other Computer Aided Design software
Acoustic Signature Management	Fishermans Bend (VIC)	Computerised control of a high speed camera for bubble dynamics measurement	This project will use a high speed camera to explore the process of bubble formation underwater. Properties of bubble plumes are of great interest for many engineering applications and an active area of research. In particular, measuring the bubble size distribution is important for plume transport characteristics and acoustic properties. Measuring these properties still presents a challenge for conventional techniques. It has been shown that the passive acoustic technique based on inverting generated acoustic noise is a promising alternative approach. However, this approach requires good insight into the bubble dynamics that demands further research that is the aim of this project. The experiments will be conducted in a small water tank located at DST Fishermans Bend. The control of the high speed camera or other related acoustic measurement devices that will form a large part of this investigation will also benefit the existing bouyancy driven model program (designed to measure flow noise), so this project will also consider the application of these techniques to this.									<ul style="list-style-type: none"> • Skills or interests in computer system engineering: computer hardware, hardware control, image processing and acoustic devices • Ability to work in a team.

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Maritime Autonomy	Eveleigh (SYD)	Control and measurement of pressure and seismic sensor calibration apparatus	DST Group has recently built the hardware to support some unique facilities for calibrating pressure sensors and seismic sensors. The aim of this project is to build the supporting software (in Labview) to control and monitor the physical equipment and measure and manipulate data that is recorded from them.									<ul style="list-style-type: none"> • Computer science • Labview programming
Undersea Command & Control	Stirling (WA)	Near Sea Surface Image Propagation	Model the effects of the atmosphere on optical properties for imaging systems that operate near the sea surface. Compare existing physics based atmospheric propagation models and their predicted impacts on image propagation, with existing measurement data. The near sea surface boundary layer has unique properties and synergies with climate science. Atmospheric effects include aerosol scattering and refraction.									<ul style="list-style-type: none"> • Basic matlab data analysis • Atmospheric physics or meteorology • Imaging systems
Maritime Autonomy	Eveleigh (SYD)	Object Detection	This project will aim to implement object detection models for the classification of hyperspectral imagery. The project will focus on the implementation of the major architectural designs known as SSD and YOLO and implement these using the pytorch deep learning framework.									<ul style="list-style-type: none"> • Experience in Convolutional Neural Networks, Deep Learning, Python, Pytorch
Maritime Autonomy	Eveleigh (SYD)	Moving vessel collision avoidance for autonomous underwater vehicles	Autonomous underwater vehicles (AUVs) such as the REMUS 100 (www.hydroid.com) are useful tools for high-resolution marine survey. They can navigate very accurately underwater, but they can't sense the environment around them, particularly moving vessels. This makes AUV navigation in seaways and harbours hazardous and a system that could sense oncoming vessels and allow the AUV to avoid them would be very valuable. This project aims to see whether an acoustic sensing system would be useful for collision avoidance. Most vessels emit a lot of sound into the water, so they are not difficult to detect, but different vessel types require different behaviours. This project will apply machine learning to acoustic data to see whether it is possible to recognise, classify and track vessels. The first part of the project will be data collection using hydrophones and a video camera. The bulk of the project will be gaining familiarity with techniques from machine learning and applying them to the data. This is likely to involve adapting software developed at DST, and applying techniques from recent research papers.									<ul style="list-style-type: none"> • Good results in mathematics and computing. Familiarity with data collection and signal processing would be an advantage. Some familiarity with machine learning would be desirable, but a significant part of the project will be learning about this topic.
Maritime Autonomy	Eveleigh (SYD)	Near-field Underwater Communications	Autonomous underwater vehicles rely on data cables and connectors for data transmission. Salt-water-tolerant electrical contact connectors are expensive and prone to failure in challenging environments. The first part of the project would be to review other technologies (e.g. electromagnetic induction or optical) for providing data connections for underwater vehicles in cost-effective ways. Considerations would include tolerance of the marine environment (salt water, pressure, vibration, marine growth); SWAP (size, weight and power); cost; bandwidth; capacity for reliable wet make/break connections. The next part of the project would involve testing two or three proposed data connection systems in a marine environment and reporting on the results.									<ul style="list-style-type: none"> • Competence and experience in electrical or mechanical engineering.

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Sonar Technology & Systems	Edinburgh (SA)	Precision phase measurement for fibre optic sonar	The Advanced Sensors Lab are in the process of building a sonar seabed array system to demonstrate the state-of-the-art in fibre laser sensing technology for underwater acoustics. The whole system - from the sensors through to the sonar signal processing - will be built here. A fibre laser acoustic sensor works by turning sound vibrations into modulations in the output frequency of an optical fibre laser. Sophisticated interferometry techniques are required to measure and record the signal. We call this process demodulation. The current implementation of the demodulator is in Labview. The demodulated acoustic signals are passed to a sonar signal processor to produce typical sonar displays (such as bearing-time-records). Your project would be to work on either the Labview demodulation, or the signal processing (depending on your particular skills and interests).									<ul style="list-style-type: none"> For the demodulation software, Labview experience is essential For the sonar signal processing, familiarity with Matlab, C/C++ are required An understanding of basic signal processing concepts such as spectral analysis would be beneficial.
Undersea Command & Control	Edinburgh (SA)	Assessing the impact of seabed properties on acoustic propagation using statistical techniques.	This project will involve assessing seabed sediment data for locations around Australia, and investigating statistical techniques for describing the expected variability in acoustic propagation due to sediment properties.									<ul style="list-style-type: none"> Statistics or information processing techniques, and interest in applying these to build understanding of aspects of the underwater environment Knowledge of an environmental science like geophysics or oceanography, and programming skills in Matlab or general software development, will be beneficial Good communication skills and willingness to work in a small team environment.
Undersea Command & Control	Edinburgh (SA)	Command Function Select (CFS) Radio Frequency (RF) Transmitter	This project will build a software defined Radio Frequency (RF) transmitter to be used to command sonobuoy underwater acoustic sensors									<ul style="list-style-type: none"> Experience in Python/C++ and some understanding of RF transmission theory and techniques Good communication skills Ablity to work in teams Motivated and goal-focussed
Maritime Platform Performance	Fishermans Bend (VIC)	Ultimate and Fatigue Strength Assessment of Degraded Naval Surface Structures	<p>A naval vessel is complex structure, designed to operate in a safe and efficient manner throughout its useful life (design life). In order to achieve this, a platform is first designed against a set of criteria that determines sufficient safety against failure for a number of structural failure modes such as buckling against extreme loads and fatigue failure for through-life cyclic loads.</p> <p>Structural deterioration from corrosion and fatigue cracking is the cause for a significant percentage of naval assets being removed from service. Defence Science and Technology is conducting research and collaborating with international partners under The Technical Cooperation Program (TTCP) arrangement to develop robust toolsets and assessment methodologies to assess the structural integrity, safety and survivability of ageing naval platforms through experimental and numerical work. The objectives of this project are</p> <ol style="list-style-type: none"> The development and validation of toolsets and methodologies to assess structural integrity, safety and survivability of degraded (ageing) naval platforms. Provide advice on effective maintenance strategies of naval platforms Provide advice on Life of Type and Life of Type Extension of naval platforms 									<ul style="list-style-type: none"> Experience in finite element analysis Structural strength assessment Naval architecture Strong team work skills Motivated and goal-focussed

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Land Vehicles & Systems	Edinburgh (SA)	UAS telemetry exploration	<p>The Advanced Vehicle Systems (AVS) Group of Land Division in DST utilises a number of Unmanned aerial Systems (UAS) for research purposes. A number of the UAS have associated software development kits (SDKs). The UAS themselves range in cost from a few hundred dollars to about \$20,000. To support the ongoing research work in AVS, accurate pose and sensor orientation data needs to be available in real time. SDKs exist for all of our platforms, allowing the exchange of data between the drone and user software. Depending on the drone platform the user software can interact with:</p> <ul style="list-style-type: none"> • The hand held drone controller (and the aircraft data that it has access to) • The drone's on-board computer • A computer carried as an interconnected payload on the drone <p>Note: the use of a controller based SDK (rather than on-board or payload based SDK) means that problems can addressed by manually taking over control, or by relying on the 'return-to-base' behaviour that is invoked when the control link is broken.</p>									<ul style="list-style-type: none"> • Software development, experience with drones
Land Vehicles & Systems	Edinburgh (SA)	Graphical User Interface Design and Development for Ravos Vehicle Control System	<p>The Advanced Vehicle Systems (AVS) Group of Land Division in DST is undertaking research and development of a distributed control system for fleet land vehicles called Ravos. The goal of Ravos is to enable the automated reconfiguration and optimisation of vehicle-hosted mission systems exploiting contextual awareness of the environment and to adapt to adversarial action.</p> <p>The current application of Ravos is towards the protection of vehicles against a number of unmanned aerial threats. Ravos in the future will employ a number of algorithms to autonomously determine across a fleet of vehicles, which vehicle and which counter measure should be employed to provide protection against a given threat.</p> <p>This alert information needs to be displayed to a military operator via a Graphical User Interface (GUI). Additionally feedback on the success/failure of the engagement needs to be reported across the vehicle fleet again via a GUI.</p> <p>The developed GUI will be preferably be implemented in the Java programming language. However other languages can be used. A stretch goal for this project is to further integrate the developed GUI into an existing vehicle control system implemented in the Australian version of the Generic Vehicle Architecture using the Data Distribution Service (DDS).</p>									<ul style="list-style-type: none"> • Software development, particularly with GUIs, experience with computer networking
Land Vehicles & Systems	Edinburgh (SA)	Machine Learning Approaches for Vehicle Protection	<p>The Advanced Vehicle Systems (AVS) Group of Land Division in DST is undertaking research and development of a distributed control system for a fleet land vehicles called Ravos. The goal of Ravos is to enable the automated reconfiguration and optimisation of vehicle-hosted mission systems exploiting contextual awareness of the environment and to adapt to adversarial action.</p> <p>The current application of Ravos is towards the protection of vehicles against a number of unmanned aerial threats (referred to as "counter UAS"). In the future, Ravos will employ a number of artificial intelligence (AI) algorithms to autonomously determine across a fleet of vehicles, which vehicle and which counter measure should be employed to provide protection against a given threat. In this case, the objective of Ravos is to manage the vehicles' counter measure resources such that survivability of the fleet over the course of a mission is maximised.</p> <p>The AVS group has developed a simulation to model this vehicle protection scenario as an environment in openAI gym (https://gym.openai.com/). The aim of this project is to implement a number of heuristic agents in Python within the environment. A stretch goal for the project is to explore and implement one or more other machine learning algorithms within the environment and compare results.</p>									<ul style="list-style-type: none"> • Experience in machine learning/AI;
Land Vehicles & Systems	Edinburgh (SA)	Low Probability of Detection Networking	<p>The Advanced Vehicle Systems (AVS) Group of Land Division in DST is undertaking research and development of a distributed control system for a fleet land vehicles called Ravos. The goal of Ravos is to enable the automated reconfiguration and optimisation of vehicle-hosted mission systems. One such system is the on-board tactical radio network; this project is concerned with reducing the detectability of vehicle RF communications by manipulating transmission power based on real communication requirements. This will initially focus on manipulation of transmission powers based on vehicle positions. The project will involve the implementation, extension and analysis of extant low probability of detection algorithms s within an RF radio testbed.</p>									<ul style="list-style-type: none"> • Experience in networking technologies and RF communications • Software development skills

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Land Vehicles & Systems	Edinburgh (SA)	Detection and Classification of Unmanned Aerial Threats Using Computer Vision	<p>The Advanced Vehicle Systems (AVS) Group of Land Division in DST is undertaking research and development of a distributed control system for a fleet land vehicles called Ravos. The goal of Ravos is to enable the automated reconfiguration and optimisation of vehicle-hosted mission systems exploiting contextual awareness of the environment and to adapt to adversarial action.</p> <p>The current application of Ravos is towards the protection of vehicles against a number of unmanned aerial threats. Ravos in the future will employ a number of algorithms to autonomously determine across a fleet of vehicles, which vehicle and which counter measure should be employed to provide protection against a given threat.</p> <p>A key challenge in engaging aerial threats is the detection and classification of them. Computer vision and machine learning allow for highly accurate classification and localisation of many common objects in images. Systems are needed however which have a focus on UAVs. With limited training data available for UAVs, various existing learning mechanisms for classification and detection will need to be combined to build a detection system capable of distinguishing UAVs from other flying objects.</p> <p>An existing machine learning framework [1] and various open source datasets will be used to develop and train a visual UAV detector in the Python programming language. Stretch goals for this will be to incorporate these learning techniques into current state of the art networks.</p> <p>References: [1] J. Redmon and A. Farhadi, "Yolo9000: Better, faster, stronger," in 2017 IEEE Conference on Computer Vision and Pattern Recognition (CVPR), July 2017, pp. 6517–6525.</p>								<ul style="list-style-type: none"> • Experience with Machine learning • Software development/programming and computer vision 	
Land Vehicles & Systems	Fishermans Bend (VIC)	Development of a dynamic punch apparatus for armour material testing	<p>This project will focus on the design and fabrication of a new punch testing apparatus to study armour materials under biaxial loading similar to that produced by blast weapons such as landmines or IEDs. This new testing capability is intended to provide valuable insight into how armour materials deform and fail under highly dynamic biaxial loading by allowing instrumentation which is not possible in full scale explosive experiments. The student will utilise computational design techniques to support the development of the new apparatus as well as conduct experimental testing to evaluate the feasibility of the final design.</p>									<ul style="list-style-type: none"> • Computer Aided Design (CAD), Mechanical Testing
Land Vehicles & Systems	Fishermans Bend (VIC)	Active Concepts for Blast Protection of Vehicles	<p>This project will focus on exploring novel blast protection techniques that use active protection concepts to provide enhanced protection to military vehicles. The use of these protection concepts is intended to either reduce the weight of the armour system required to defeat blast threats and/or allow protection against more severe threats without increasing the mass of the vehicle. Numerical simulations will be used to evaluate the feasibility of different concepts which involve the use of an explosively driven armour package to defeat blast threats. The evaluation will also involve comparisons to more conventional armour packages of similar mass.</p>									<ul style="list-style-type: none"> • While some experience with commercial Finite Element Analysis (FEA) or Computational Fluid Dynamics (CFD) packages is beneficial, training will be provided as part of the project.
Land Personnel Protection	Fishermans Bend (VIC)	Radiological source mapping	<p>This project will involve the mathematical analysis of data from radiation detection equipment to identify sources of radiation and represent them in mapping and geospatial software. The project will initially use data from the DST developed gamma imaging system, but may extend to analysing data from a range of radiation detection equipment that is used by the Australian Defence Force.</p>									<ul style="list-style-type: none"> • Experience in mathematical modelling, statistical analysis and data fusion • Software for data analysis and fusion will be written as part of this project so experience with software development and coding is desirable. • A knowledge of experimental physics, including in radiation detection would also be useful.

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Chemical & Biological Defence	Fishermans Bend (VIC)	Development of a standard operating procedure for the quantitation of peracetic acid in decontamination solutions	Effective decontamination and remediation of equipment and areas contaminated with chemical warfare agents is an ongoing problem. There are currently many different types of chemistry used to degrade these contaminants. Oxidisers such as hydrogen peroxide and peracetic acid are one class of reagent commonly used. To understand the reaction mechanism of a decontamination process the exact concentration of these compounds in solution must be known. This project aims to establish a quantitative method for determining the concentration of peracetic acid in various solutions. The outcome of this will be the production of a standard operating procedure to carry out this analysis.									<ul style="list-style-type: none"> Experience in wet chemistry analytical techniques such as colourimetric chemistry Experience in working in a laboratory environment Knowledge of gas and liquid chromatography Excellent verbal and written communication skills
Land Vehicles & Systems	Edinburgh (SA)	Robotic Kelpie	Land Vehicles and Systems Branch is looking to help further develop a concept called Kelpie. This is an optionally-crewed robotic platform, able to be operated manually as well as function autonomously. It will provide assistance to soldiers in such tasks as carrying equipment or acting as a sentry. To achieve this many fundamental autonomous behaviours such as path planning, navigation, and object detection, recognition and avoidance need to be integrated and to do so will involve exploring technologies such as computer vision and Machine Learning. Other technologies such as facial recognition, voice control, and hand gesture recognition will be investigated in order to control the Kelpie platform. The project will involve working together with the Kelpie team predominately in software development and platform testing. There may also be an opportunity to be involved in some hardware (mechanical and electronic) development activities.									<ul style="list-style-type: none"> Excellent computer, verbal and written communications skills Ability to work in teams Motivated and goal orientated. Background in software engineering/development desired Experience with building or experimenting with robotic platforms an advantage.
Surveillance and Reconnaissance Systems	Edinburgh (SA)	Ocean Antenna Mount Simulator	A programmable mount is being developed by DST to emulate the motion of antennas on the ocean surface. The project will require interfacing into the existing mount to control the azimuth and elevation of the antenna mast, modelling the motion of water to make the antenna swing and finally developing a GUI to allow a user to program in the sea state that will simulate antenna motion on the mount, causing the antenna to swing around.									<ul style="list-style-type: none"> Experience in software development and graphical user interfaces (GUI) would be ideal
Intelligence Systems	Edinburgh (SA)	Advanced Airborne Radar Engineering	This project is to contribute to the development of the Ingara DSTG's multi-mode airborne radar system to improve the performance of this critical research and experimentation system. The position will involve working with the radar engineering team to improve the existing design, to fabricate new components and sub-systems and to test new systems for integration into the radar system. The tasks will include Radio Frequency (RF) circuit design, RF circuit simulation, Printed Circuit Board (PCB) design and simulation, fabrication & testing.									<ul style="list-style-type: none"> Electronics Engineering experience in circuit design preferably with Radio-Frequency (RF) background Experience in programming and operating laboratory engineering equipment e.g. spectrum analysers Good software engineering and development skills Good communication skills Ability to work well within teams Motivated with self-initiative.
Intelligence Systems	Edinburgh (SA)	Text Segmentation	Text segmentation tasks are critical pre-processing steps that identify basic units to be processed in Natural Language Processing (NLP) applications. This project will focus on developing unit testing functions for JFlex rules of the two in-house text pre-processing tools, to verify the accuracy of each JFlex rules. Building a unit test suite for these pre-processing tools is very important as errors made at these phases will propagate to later phases of NLP and causing compounding problems.									<ul style="list-style-type: none"> Programming experience in Java and knowledge in unit testing is necessary An interest in artificial intelligence, natural language processing, machine learning, and/or skills in languages other than English are desirable but not essential

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High Frequency Radar	Edinburgh (SA)	Noise Cancellation in High Frequency (HF) Radar	<p>High frequency (HF) skywave radars are capable of detecting targets at very long ranges, typically up to thousands of kilometres. They use HF radio waves reflecting off the earth's ionosphere for very long range detection. Australia has a unique HF radar capability known as Jindalee Operational Radar Network (JORN).</p> <p>HF radar is sensitive to atmospheric effects such as lightning strikes. Such atmospheric events could cause some samples in the radar received signal to be corrupted. Existing techniques to deal with the impulsive noise caused by lightning strikes often involve removing whole radar sweeps where the lightning strikes have occurred. Since a lightning strike affects only a few samples within a sweep, it would be more advantageous to remove only the affected samples rather than a whole sweep in a radar dwell. The challenge is how to identify the corrupted samples when the impulsive noise is weaker than radar clutter returns, but is still sufficiently strong that can prevent detection of targets.</p> <p>In this project, the student will have the opportunity to develop new and efficient signal processing techniques to mitigate impulsive noise in HF radar signals. The student will work closely with the researchers in the DST HF Radar Branch during the period to gain valuable work experience in a Defence research environment.</p>									<ul style="list-style-type: none"> Signal processing skills Good mathematical skills Programming in MATLAB Motivated and goal-focused
Information Integration	Edinburgh (SA)	Space System Development	<p>Buccaneer is a Defence nanosatellite mission currently in development that will demonstrate experimental space-based calibration of Australia's HF radar systems. It is expected to launch in 2021. It also hosts some novel secondary payloads, such as a laser communications transmitter and an actuated deployed mirror system.</p> <p>At the time of this Student Program, the Small Satellite team will be in the middle of manufacture and testing of some of the secondary payloads on Buccaneer, as well as software development and testing for scripts that will run on the primary spacecraft bus. In addition, there will also be infrastructure improvements on the DST Ground Station.</p> <p>The student will have the opportunity to work closely with researchers within the Small Sat team on any of these aspects of the mission. A more defined work program will be developed based on the particular skills of the student accepted.</p>									<p>Experience in one or more of the following:</p> <ul style="list-style-type: none"> Software development in C++ in Linux Circuit design and fab; Mechanical design and modelling Systems engineering
Surveillance and Reconnaissance Systems	Edinburgh (SA)	Satellite signal level catalogue	The project will develop a catalogue of RF signal levels due to RF transmissions from satellites as a passive radar planning tool									
Surveillance and Reconnaissance Systems	Edinburgh (SA)	Design of an Active RF Retro-directive Array Reflector	Retrodirective array reflectors have found many applications in the area of collision avoidance systems, satellite communications and enhancing radar cross section. The project involves the design, fabrication and testing of an active retrodirective Van Atta array.									
Aerospace Capability Analysis	Fishermans Bend (VIC)	Understanding bias in knowledge elicitation activities	<p>In ACA we often call on subject matter experts (SMEs) to make judgements such as: the performance of a weapon or sensor; the outcome of a military engagement; or number of aircraft required to complete a mission. The main reason for relying mostly on SME judgement is that the problem is too complex to mode using traditional modelling methods.</p> <p>However, SME judgements are clouded by personal, cognitive and other biases. Further, there is a poor correlation between the quality of the SMEs response to their perceived confidence or experience in the question of interest. There are a range of techniques that can be used to reduce and control for these biases including: using neutral language, specific ordering of questions, seeking rationale for responses, training SMEs to de-bias their responses, peering reviewing responses and aggravating responses from experts.</p> <p>The project will investigate the range of techniques available as well as designing and conducting experiments to investigate one aspect of bias relevant to this task. Outcomes of this project may include development of a set of best practice guidelines for the practitioner, or improve the available data collection tools including writing scripts to integrate into LimeSurvey. The result will be applicable to all areas of JOAD that rely on knowledge elicitation methods.</p>									<ul style="list-style-type: none"> Undergraduate in Science, engineering, management or psychology Knowledge or interest in knowledge elicitation and bias Experience in survey design, programming or using macros in Microsoft Office Knowledge and experience in PHP, LimeSurvey and excel will be viewed favourably

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Aerospace Capability Analysis	Fishermans Bend (VIC)	Exploring human-machine trust: understanding the factors that lead to mis-use and dis-use of autonomous systems	Autonomous systems are expected to be disruptors for the Royal Australian Air Force (RAAF). The systems have many advantages compared to standard systems but misuse and disuse of these systems will undermine their intended efficiencies. Research into Human-Machine trust can be divided into dispositional trust, situational trust and learned trust. This research project will investigate the factors that contribute to disuse and misuse of automated assistance and will include designing and conduction experiments to investigate one aspect of trust relevant to this task. Outcomes of this project may include development of a set of best practice guidelines for the practitioner, or improve our understanding of factors that influence human-machine trust.									<ul style="list-style-type: none"> Undergraduate in Science, engineering, management or psychology Knowledge or interest in knowledge elicitation and bias Experience in survey design, programming or using macros in Microsoft Office Knowledge and experience in PHP, LimeSurvey and excel will be viewed favourably
Aerospace Capability Analysis	Fishermans Bend (VIC)	Developing tools to support knowledge elicitation activities	In ACA we often call on subject matter experts (SMEs) to make judgements such as: the performance of a weapon or sensor; the outcome of a military engagement; or number of aircraft required to complete a mission. The main reason for relying mostly on SME judgement is that the problem is too complex to mode using traditional modelling methods. Knowledge elicitation from SMEs can range from small scale focus groups to large scale online surveys. This project will investigate suitable tools to support online data acquisition as well as post activity processing. Outcomes of this project may include development of a set of tools to improve data collection, data processing and data presentation for integration into LimeSurvey of DSTG's own in-house developed software written in python.									<ul style="list-style-type: none"> Undergraduate in Science, engineering, management or psychology Knowledge or interest in knowledge elicitation and bias Experience in survey design, programming or using macros in Microsoft Office Knowledge and experience in Python, PHP, LimeSurvey and Excel will be viewed favourably
Joint Capability Analysis	Fairbairn (ACT)	Experimentation in sociotechnical context	The project focuses on planning and designing series of sociotechnical experiments to systematically test hypotheses about organisational structures and processes, and to develop appropriate transition paths for introduction of new innovation in terms of 'smart' technology and incorporate it into organisational practices. The setting of the study is a busy military operational headquarters (HQ) responsible for the command and control of Australian Defence Force operations worldwide. The work performed is typically knowledge work. While the majority of personnel are 'day-workers', there are shift 'watch' staff on a 24 hour/7 day roster. The staff use a plethora of ICT tools and applications to conduct their work.									<ul style="list-style-type: none"> Good communication skills, written and oral Ability to work in teams, Motivated and goal-focussed Familiarity with research methods/design
Joint Capability Analysis	Fairbairn (ACT)	Unified mathematical model of warfighting with C2 & ISR	The project seeks to continue the development of a mathematical model of warfighting that incorporates a range of fundamental capabilities including combat, command and control, situation awareness and force sustainment. It builds upon an existing model posed as differential equations developed in DST's Modelling Complex Warfighting strategic research. In particular, this project will seek to build in entities engaged in Intelligence-Surveillance-Reconnaissance (ISR) that interact within combat and Command and Control (C2) entities such as operational headquarters. The work will involve a large degree of numerical solution and, where possible, analytic treatment in certain approximations.									<ul style="list-style-type: none"> Strong mathematical skills Ability to work with mathematical packages such as Mathematica Good communication and writing skills Able to work in a team environment.
Land Capability Analysis	Edinburgh (SA)	Visual CONEMP	The development and delivery of military concepts of employment (CONEMP) usually takes the form of simple graphics, sounds and supporting text. This form of communication cannot effectively represent future complex operating environments or large complex capability systems with many dynamic elements. The aim of this project is to demonstrate the ability of gaming and immersive virtual environments to engage stakeholders to enhance their understanding of the CONEMP. Can technology take a narrative and immerse the reader in an environment whereby they can experience and be infused with the concept. The focus of the project is on military concepts at the tactical level of command. A potential example is the manned-unmanned teaming of soldiers, armour and autonomous systems in the conduct of urban close combat.									<ul style="list-style-type: none"> General software development skills Computer game development Excellent computer, verbal and written communications skills are required to undertake this project

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Land Capability Analysis	Edinburgh (SA)	Future Technology Concept Exploration (FTCE) Evaluation Framework	<p>Future technologies are expected to have a profound effect on Army's future capabilities and the way they are operated and used to achieve their designated goals. These emerging technologies may not have shown their potential yet, just as well the time until their maturity is uncertain.</p> <p>Army and Industry need analysis-based, solid evidence in order to make their investment decisions. The focus of the project will be the development of a framework enabling the rigorous evaluation of these technologies and the corresponding concepts for utilisation.</p>									<ul style="list-style-type: none"> Critical thinking ability – highly desirable
Maritime Capability Analysis	Eveleigh (SYD)	Data Analytics for Naval Platforms	<p>Naval platforms routinely collect vast amounts of data during operations. This data is becoming increasingly valued for supporting evidence-based decisions to improve the effectiveness and availability of Naval capabilities. In DST, the Maritime Capability Analysis (MCA) branch is developing data analytics techniques and systems to exploit operational data from Navy ships for capability decision making. Current efforts centre on ship navigational data, such as GPS tracks and weather measurements. Data fusion with e.g. Bureau of Meteorology data sets and more involved analysis is the most recent direction of research efforts.</p> <p>In this project, the student will apply data analytics techniques in a Big Data cluster computing environment to characterise navigational data sets. Developing a statistical understanding of the data will be a major focus so that suitable data analytics applications can be identified. Data analytics work will develop and apply software routines to assess data coverage and completeness as well as statistical properties such as noise and periodicity. Further effort may apply clustering and machine learning tools to the data to aid automatic processing and visualisation.</p> <p>Interested candidates should note that some aspects of this project can be shaped to suit individual student skills and interests, e.g. to focus more on statistical modelling, or on efficient computational processing and visualisation.</p>									<ul style="list-style-type: none"> Programming experience, e.g. Python, MATLAB. Quantitative modelling skills. Familiarity with basic statistical methods. Experience with Pandas package (Python) is desirable, but not essential. Familiarity with cluster or parallel computing is desirable, but not essential. Experience in machine learning is desirable, but not essential.
Strategic Capability Analysis	Fairbairn (ACT)	Gamifying the construction and integration of a Joint Force (SVP)	<p>Constructing and maintaining an effective Joint Force is a daunting task. Choosing relevant capabilities and force elements, each with their own nuanced advantages and risks; carefully considering their synergies when employed in groups, whilst also considering their cost to build and maintain can tax even the skilled and experienced practitioner. In this project we seek to test the utility of current and future Force Design techniques by applying them to contemporary trading card games where success largely relies on deck-construction from a very large pool of cards; enabling us to test techniques and algorithms from Force Design in an adversarial setting. This project intends to provide a link from cutting edge Operational Research being conducted within the Modelling Complex Warfighting Strategic Research Initiative, to wider Australian Defence Force Headquarters needs concerning Force Design and Integration.</p>									<ul style="list-style-type: none"> Experimental skills, manufacturing testing, modelling skills, software development Excellent computer, verbal and written communications skills are required to undertake this project. Good communication skills, Ability to work in teams, Motivated and goal-focussed
Strategic Capability Analysis	Fairbairn (ACT)	Meta-megatrends Analysis (SVP)	<p>The strategic context is a critical element for planners, policymakers and capability developers. It allows them to make the appropriate choices by maximising opportunities and minimising risks to better prepare for the future. The aim of this project is to establish a coherent plausible range of future environments by synthesising available resources on megatrends and capturing the underlying assumptions and evidence base that is suitable for the Australian defence planning. Student will have opportunities to:</p> <ul style="list-style-type: none"> learn about megatrends, future concepts development, futures, forecasting, scenario learning and simulation gaming; use specific methods/tools/techniques including systematic literature review, meta-synthesis, semi-structured interviewing, Defence/DST report writing and presentation; and use statistical analysis, systemic analysis and data mining software may also be available. 									<ul style="list-style-type: none"> Problem scoping, problem analysis, systems design Project management, time management, motivated, goal-focussed Communications (written and verbal), teamwork

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Science Engineering Services	Edinburgh (SA)	Design and programming of Robot Arm	Undertake mechanical design and robot arm programming activities to create customised materials and/or geometries. Mechanical design activities may include development of customised hardware required to be attached to the end of the robot arm platform for securing and holding a variety of components. Robot arm programming activities will be required to coordinate the positioning and deposition of various components. The summer vacation placement will contribute to the development of a specialised research capability.									<ul style="list-style-type: none"> • Experience in mechanical CAD. • Experience in any programming language • Ability to work in teams • Good communication skills • Motivated and goal-focused.
Science Engineering Services	Edinburgh (SA)	Design and programming of a intrinsically safe firing system	Undertake design and programming of an embedded control system of an intrinsically safe dual output firing system. Electronic design activities will include design of a safe firing system with multiple redundancies, design of power electronic components of the system, selection of relevant components, design of the embedded control system, design and programming of the communication interface and design and programming of the control system. The above-mentioned tasks will require prior knowledge on electronic design and embedded systems including firmware programming in C/C++.									<ul style="list-style-type: none"> • Experience in Electronics Design Engineering including embedded systems design based on microcontrollers • Experience in Electronic CAD packages. Experience in any programming language such as C#, C/C++ or Python. • Well-motivated, open minded and willing to participate in team based projects • Good communication skills and good time management skills.
Science Information Services	Edinburgh (SA)	IT Storage and Back Up Upgrade	Software programming skills related to IT networking, storage and backup software products									<ul style="list-style-type: none"> • Software development and programming, any language