

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
Distributed Combat & Mission Systems	Edinburgh (SA)	Design and development of an automated service deployment manager	The internet-of-things is driving an approach to connected, distributed edge-computing systems. Defence projects are looking toward cloud based approaches to develop the internet-of-military-things. Such systems require modern computing application development pipelines employing technologies such as containerised services and web-based frontends enable more rapid development and technology flexibility. Such attributes also make the technologies extremely attractive to underpin research environments. A major challenge, however, within research organisations is the management, cataloguing and deployment of a large number of services to support a diverse set of researchers needs. The current project will enable a student to gain experience working with modern computing technologies to prototype a system to assist with the deployment of services to support research activities within DST. The system may also provide a concept for how real, future, military software-services may be deployed in an IoMT environment.									<ul style="list-style-type: none"> <li>Competency managing software development projects, include source code management, documentation and code tests.</li> <li>Familiarisation with building and deploying containerised services.</li> <li>Familiarisation developing web-based UI for backend services.</li> <li>Ability to work in teams and to communicate ideas both verbally and in writing</li> </ul>
Advanced Propulsion & Weapon Effects	Edinburgh (SA)	Modelling shockwave interactions from explosive charges	This project will use experiments and modelling to investigate shockwave interactions from single and multiple explosive charges. The investigation will focus on the effect of colliding shockwaves in confined spaces, and in corners. Some target responses will be modelled. Modelling will be validated with testing in the High Explosive Chambers. Outputs include modelling input files, reports and presentations.									<ul style="list-style-type: none"> <li>Experience or exposure to Finite Element Analysis (FEA) and/or Computational Fluid Dynamics (CFD) modelling software and CAD packages is desirable.</li> <li>Experimentation, general workshop skills and the ability to work in teams are also desired.</li> </ul>
Weapons Systems Technology	Edinburgh (SA)	Vision based swarm formation flights	This project aims to develop a high precision formation flight capability for multiple quadrotors (drones) through on-board processing of visual input captured by a camera mounted on each drone. This vision-based approach will allow the drones to autonomously identify a moving landing platform, track its pose to form up around it, and then safely land on it while it is moving. It will involve identification of suitable sensors, mounting systems, and visual processing algorithms for integration with the navigation function. The solution will need to work within the confines of the drone hardware limitations, and will be demonstrated at both the DST's indoor and outdoor trials facilities.									<ul style="list-style-type: none"> <li>Programming in C++ and/or Python, familiarity with open source vision libraries.</li> <li>Understanding of ROS, basic control theory and image processing</li> </ul>
Weapons Systems Technology	Fishermans Bend (VIC)	Study electronic effects of electromagnetic pulses on electronic components using CST	In an era dominated by electronic warfare facilitated by advances in electronics technology, and with the increasing use of information technology for command and control, high power radio frequency (HPRF) technologies are of increasing interest to Defence. In order to deliver full potential of the HPRF technologies for Defence applications, we need to better understand responses/performance of electronic systems/circuits/components under extremely high intensity radiated fields (HIRF) such as high-power electromagnetic pulses (EMP). This project is proposed for an IEP student to explore the CST (Computer Simulation Technology) capability to assess system susceptibility when subjected to EMP and investigate mitigation strategies.									<ul style="list-style-type: none"> <li>Study in electrical &amp; electronics engineering and physics.</li> <li>Understanding of electromagnetic theory, wave propagation, and electronic system susceptibility.</li> <li>Strong programming experience and familiarisation of software tools applied in electromagnetic waves domain</li> </ul>
Weapons Systems Technology	Edinburgh (SA)	Control of human gaze blocking drone	This project aims to develop a predictive agile controller for a drone to carry out a range of human interactive missions in an indoor environment. One example scenario would be that a drone equipped with a camera sensor enters a room, identifies a human, and autonomously flies towards the human and maintains its position directly in front of the human's head to block the person's view. This work builds on the existing DST research on human gaze estimation using machine learning, hence the successful candidate will work with the computer vision researchers to iteratively develop, test and enhance the solution techniques. The project will involve literature review of published research and relevant code libraries for quadrotor trajectory planning and control, and carrying out controller development on Ardu-copter based drones. The demonstration will occur in stages in DST's indoor flight arena, which is equipped with the Optitrack motion tracking system. The project will culminate in a physical demonstration of a team of 3 drones collaborating to persistently block the view of the moving person.									<ul style="list-style-type: none"> <li>Programming in C++ and/or Python, familiarity with open source vision libraries, robotic tools</li> </ul>

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)	Development of intelligent fuzzy controller for motion coordination of multiple drones	This project aims to develop a neuro fuzzy inference network that controls the speed and heading of multiple drones in the mission of distributed search in a semi urban area. The drones are networked and can share their sensing, local maps and intents to work as a team, and the objective of the controllers is to minimise the mission time. The ingress and egress points to the search region are arbitrarily selected before the mission, and the drones will need to decide on which buildings to visit, in which order, and via which path so that all the buildings are visited in the shortest possible time. This project directly contributes to a larger scale DST-Industry collaboration project hence the student will need to work closely with the team and also will contribute to the generation of scientific publications.									<ul style="list-style-type: none"> <li>Matlab, C++ and/or Python, evolutionary optimisation and machine learning</li> </ul>
Weapons Systems Technology	Edinburgh (SA)	Swarming capability development using Machine Learning Craig Eales	The objectives of this project are to improve the DST simulation framework in terms of incorporating a training model for drone swarms and to generate new swarm behaviours for various scenarios. The project will use an Emergency Services scenario where a swarm of drones will be tasked to carry medical supplies to injured persons in the shortest possible time. The operating environment contains many obstacles and may also present hostile entities that will result in loss of drones together with valuable medical supplies. The student will be tasked to design algorithms and machine learning models using the Gazebo simulator and ROS robotics middleware, and will utilise the DST high performance computing facilities to run the code in parallel.									<ul style="list-style-type: none"> <li>Python or C++, evolutionary optimisation and machine learning, ROS and Gazebo</li> </ul>
Weapons Systems Technology	Edinburgh (SA)	Deep learning for target detections in highly dynamic environments	This project supports the DST's project, Moral Weapons, which looks at intelligent ways of codifying reasoning's and rules into weapons ethics engine. The performance of the ethics engine will be highly dependent on kind of interpreted information that flows into it. In order to support this cognitive framework, this project will focus on utilisation of state of the art image perception algorithms to better understand the key objects (cars, people, trains, etc.) in a targeting scenario from an airborne, fast-moving sensor. By semantically understanding the types of objects around a target, we expect to make more "ethical" targeting decision and so reduce collateral damage to non-combatants. The first component is to generate synthetic scene data (various scenarios of interest) from a drone's viewpoint using the Unreal Engine. Once this data has been generated, we want to re-train state-of-the-art deep learning based object detectors (as used on autonomous cars) to detect our objects of interest in real-time from various aerial viewpoints and flight trajectories.									<ul style="list-style-type: none"> <li>Programming in C++ and/or Python, familiarity with open source vision libraries, unreal engine</li> </ul>
Information Integration	Edinburgh (SA)	Small Satellite Mission Control Software Development	Ever wanted to operate a satellite? This exciting placement is with the Small Satellite Experimentation Team that designs, builds and operates small satellites for Defence. Mission control is a crucial aspect of satellite operations and the small satellite team is looking for an enthusiastic software developer to assist in the development of key new features, such as improved automation in mission planning, telemetry storage and graphical display. The successful candidate will also join the satellite operations team and will have the opportunity to design mission plans for and operate the Buccaneer Risk Mitigation Mission CubeSat.									<ul style="list-style-type: none"> <li>Experimental skills, manufacturing testing, modelling skills, software development</li> <li>Excellent computer, verbal and written communications skills are required to undertake this project.</li> <li>General software development skills, scripting, source control configuration management</li> <li>Good communication skills, Ability to work in teams, Motivated and goal-focussed</li> </ul>
Intelligence Analytics	Edinburgh (SA)	Cormorant	In this project you will work as part of a diverse team developing a data processing and analysis platform using industry standard frameworks. You will be involved in the design, development and testing of the Cormorant data processing system that will be used by Defence and industry partners supporting intelligence analysis.									<ul style="list-style-type: none"> <li>Highly motivated and flexible with the ability to work independently or as part of a team.</li> <li>Java or Python experience is essential.</li> </ul>

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
Maritime Autonomy	Eveleigh (SYD)	Use of Sonar in Naval Mines	Naval mines use underwater acoustics, magnetics and pressure to detect and target passing ships. It is possible they could use a sonar sensor to detect when they are being hunted by an underwater vehicle. The aim of this project is to build a prototype sonar sensor to investigate the feasibility of mines using such a sensor in the future. It will then be tested in the ocean against underwater vehicles. Different sonar signal processing routines will need to be developed, tested and adapted.									<ul style="list-style-type: none"> <li>Signal processing, electronics, electrical engineering, software development</li> </ul>
Non-Acoustic Signature Management	Fishermans Bend (VIC)	Novel materials for marine biofouling control - Either IEP or GIP project	This project requires the successful applicant to develop, test and evaluate novel materials for marine biofouling control. The project will involve the use of additive manufacturing (as well as other techniques) to manufacture material test samples, with the successful applicant involved in all aspects of the production, from concept design to manufacture. Materials will be tested under laboratory and real world conditions, with some fieldwork required.									<ul style="list-style-type: none"> <li>Experimental skills, manufacturing testing, modelling skills, fieldwork experience</li> <li>Excellent computer, verbal and written communications skills</li> <li>Ability to work in teams, Motivated and goal-focussed</li> </ul>
Chemical & Biological Defence	Fishermans Bend (VIC)	Enzyme immobilisation in porous materials for chemical protection applications	<p>Certain enzymes are able to convert highly toxic compounds (such as organophosphorus nerve agents) into non- toxic compounds. However, maintaining enzyme stability and activity in a useful material are two key issues that determine the utility of enzyme systems in the real world.</p> <p>This project will immobilise enzymes such as organophosphorus acid anhydrolase (OPAA) and/or phosphodiesterase (PTE) on synthetic materials such as polyurethanes and bio-derived materials such as gelatin and melanine to determine the polymer structures and chemical environments best suited to support the stability and activity of the enzymes for the adsorption and degradation of chemical warfare agents. These results will be used to identify enzyme systems that can be used in chemical decontamination and protection applications.</p>									<ul style="list-style-type: none"> <li>Chemistry/Biochemistry laboratory skills</li> <li>Good communication skills</li> <li>Ability to work in teams</li> <li>Self-motivated and goal-focussed</li> </ul>
Chemical & Biological Defence	Fishermans Bend (VIC)	Fluorescence sensor development for aerosol detection in manikin system testing	Defence is currently enhancing its aerosol detection capability for the testing of protective ensemble suits using the manikin system. This project will assess an alpha prototype low burden aerosol sensor developed at DST Group. The project will involve the testing and characterisation of suitable particles capture filters (novel & commercial) for use in the sensor and other related features to optimise the platform. Following this, further miniaturisation and sensitivity will be explored.									<ul style="list-style-type: none"> <li>Good wet chemistry experimental skills</li> <li>Good at trouble shooting</li> <li>Proficient computer skills</li> <li>Excellent verbal and written communications skills are required to undertake this project.</li> <li>Ability to work in teams and must be motivated and goal-focussed</li> </ul>
Chemical & Biological Defence	Fishermans Bend (VIC)	Method development of a Multiple Reaction Monitoring for the detection of nitrogen mustard adducts from exposed human plasma	Defence is currently an "OPCW Designated Laboratory for Biomedical Samples". The designation benchmarks DSTs capability internationally and enables us to assist in international investigation of alleged use of Chemical Warfare Agent from biomedical samples. To maintain this designation, the laboratory must successfully complete the annual Proficiency Test for Biomedical Samples administered by the OPCW. At the most recent meeting with OPCW, it was suggested that future proficiency tests will involve providing evidence of exposure to the nitrogen mustards. This project will involve the adaptation of the current methodologies used for the identification of biomarkers for sulfur mustard for the nitrogen mustards that will be vital for the successful completion of future tests involving the nitrogen mustards.									<ul style="list-style-type: none"> <li>Good communication skills, the ability to following instructions and understand scientific literature</li> <li>Good wet chemistry experimental skill</li> <li>Knowledge of mass spectrometry, ability to work in a team</li> <li>Understanding of protein chemistry and purification</li> <li>Self-motivated and the courage to seek assistance when faced with problems</li> </ul>

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
Land Personnel Protection	Fishermans Bend (VIC)	Robotics/Megatronic	This project will work to enhance the robot hardware in use by the team. This will include a number of ground vehicles in order to navigate complex terrain.									<ul style="list-style-type: none"> <li>Background in Robotics/Mechatronics, including hands on experience with robotic hardware and software</li> <li>Strong interest in development of robotic systems.</li> </ul>
Land Personnel Protection	Fishermans Bend (VIC)	Nanotechnology at the Surface	The aim of this project is to modify fabric surfaces that are able to absorb or repellent certain liquids. The nanostructure roughness of fabric will be developed using a plasma treatment or chemical coating. The treated fabric materials will be used to fabricate new chemical protective clothing.									
Land Personnel Protection	Fishermans Bend (VIC)	Measurement and characterisation of spectral properties of man-made materials and relevant natural terrain background elements using hyperspectral imaging sensors and spectral radiometers for land asset signature study	This project will require the researcher to use hyperspectral imaging sensors and spectral radiometers and other associated instrumentation to conduct data collection, measurements and analysis both in the laboratory and in the field trial. A comprehensive material and field elements spectral data base will be developed to support the Land division's Lelantos' modelling and simulation demonstrator development.									<ul style="list-style-type: none"> <li>Experimental skills in using instrumentation and data analysis</li> <li>Self-motivated and outcome focussed</li> </ul>
Land Personnel Protection	Fishermans Bend (VIC)	Development of novel sensor algorithm for object D.R.I. using hyper-cube data	This project will require the researcher to use computer vision, machine learning/deep learning techniques and hyperspectral data cube to develop a predictive model and novel sensor algorithm for object detection, recognition and identification considering both spectral and spatial content of the scene.									<ul style="list-style-type: none"> <li>Modelling skills</li> <li>Software development skills</li> <li>Scripting and Matlab experience</li> <li>Self-motivated and goal-focussed</li> </ul>
Land Personnel Protection	Fishermans Bend (VIC)	Integrated Ballistic Helmet	The project will look at a novel concept for the next generation of ballistic helmet design and materials									<ul style="list-style-type: none"> <li>Integrated design skills or material science experience</li> <li>Ability to work in a diverse team.</li> </ul>

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
Land Personnel Protection	Fishermans Bend (VIC)	Novel Body Armour Design	The Novel Body Armour Design project will explore different ways of designing hard armour plates to better understand, and improve the protection against high velocity projectiles. This project will combine design, modelling, armour manufacture and testing.									<ul style="list-style-type: none"> <li>Engineering Design</li> <li>Material Science</li> <li>Experimental Skills</li> <li>Strong written and verbal communication</li> <li>Ability to work in teams and as an individual.</li> </ul>
Land Personnel Protection	Fishermans Bend (VIC)	Multifragmentation Ballistic Impacts	The project will simulate multiple ballistic impacts on ADF Personal Protection. This will combine and validate experimental and computational methods.									
Land Personnel Protection	Fishermans Bend (VIC)	Biosimulants for personal Protection	The project will assess current biosimulants, determine potential options that would better represent the response of the human and validate these materials.									<ul style="list-style-type: none"> <li>Material science and physics</li> <li>Ability to work in a diverse team</li> </ul>
Land Personnel Protection	Fishermans Bend (VIC)	Human-Robot Teaming/Simulation	This project will build on the work done with gesture based gloves for the control of an unmanned ground vehicle. The work will involve both hands on work on the robot and gesture device, as well as simulation of the equipment in a virtual environment.									<ul style="list-style-type: none"> <li>Background in Computer Science with some experience or interest in computer simulation.</li> <li>A knowledge of robotics and some experience with control of robots (unmanned ground or aerial vehicles), desirable.</li> </ul>
Land Personnel Protection	Fishermans Bend (VIC)	Augmented Reality	This project will enhance existing work on the linking of sensor information to an augmented reality display, such as glasses/tablet/phone. The successful student will work on the technology aspects of integrating sensor data (from a camera, temp gauge etc.) to an augmented display.									<ul style="list-style-type: none"> <li>Background in Computer Science</li> <li>Experience in the use of augmented reality displays, coding or use would be highly desirable.</li> </ul>



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
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> <p>Objectives</p> <ol style="list-style-type: none"> <li>1. Improve the rigour of techniques used by ACA to support Defence decision-making</li> <li>2. Improve our understanding of the causes of bias and the methods for reducing and controlling for bias surveys</li> <li>3. Develop a tool to facilitate survey delivery, data analysis and presentation</li> </ol>								<ul style="list-style-type: none"> <li>• Undergraduate in Science, engineering, management or psychology</li> <li>• Knowledge or interest in knowledge elicitation and bias</li> <li>• Experience in survey design, programming or using macros in Microsoft Office</li> <li>• Knowledge and experience in PHP, LimeSurvey and excel will be viewed favourably</li> </ul>	
Aerospace Capability Analysis	Fishermans Bend (VIC)	Simulation Development to Analyse Defence Operations	<p>Improve the existing functionality and adding modules into a deployable simulation framework by working in a team across the whole software development lifecycle. The aim is to produce a cost-effective, easy to use capability for operations analysis. This capability will be used by Defence to improve its effectiveness in conducting aerospace operations. Develop a flexible, capable tactics modelling environment. This capability will be written in Python, and will allow Defence operators to improve tactics, techniques and procedures employment in real-world missions.</p>									<ul style="list-style-type: none"> <li>• General software development skills</li> <li>• Familiarity with object -orientated programming</li> <li>• Interest in artificial intelligence</li> <li>• Interest in game development/simulation</li> <li>• Interest in high-performance cluster computing environments</li> <li>• Motivated and goal-focussed</li> <li>• Good verbal and written communication skills</li> <li>• Ability to work in teams</li> </ul>
Land Capability Analysis	Fairbairn (ACT)	Software Developer for Advancing a Whole-of-Force Agent-Based Simulation	<p>Force Design in the ADF relies heavily on qualitative approaches such as war-gaming. While the approach has merit, it is challenged by the increasing complexity of modern operations. This project explores how simulation based analysis can support force design decision making by quantifying relative capability value.</p> <p>The selected candidate will be involved in augmenting an existing agent-based simulation model to represent defence operating concepts of interest.</p>									<ul style="list-style-type: none"> <li>• Modelling skills, software development</li> </ul>
Land Capability Analysis	Edinburgh (SA)	Visual CONEMP	<p>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.</p> <p>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.</p> <p>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.</p>									<ul style="list-style-type: none"> <li>• General software development skills</li> <li>• Computer game development</li> <li>• Excellent computer, verbal and written communications skills are required to undertake this project</li> </ul>



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
Land Capability Analysis	Edinburgh (SA)	Combat Simulation Analyst Workflow	We design and analyse simulation experiments to explore combined arms close combat for Army and we have developed a growing number of stand-alone and specific analytical techniques. This project will develop an overarching workflow/pipeline of analysis and the corresponding software to integrate, and generalise, the analytical techniques.									<ul style="list-style-type: none"> <li>Software development and excellent computer skills are required to undertake this project.</li> <li>Good communication skills, motivated and goal-focussed.</li> </ul>
Land Capability Analysis	Edinburgh (SA)	SimR Web Services Developer	<p>SimR is a simulation repository service heavily used by LCA to support its studies. It has a web front end that allows users to manage, view, visualise and edit data within the repository. As we continually develop SimR, this front end needs constant improvement to maintain a consistent user experience.</p> <p>The student will enhance the SimR web front end through a number of subtasks:</p> <ul style="list-style-type: none"> <li>Develop a Battlebook capability which displays key statistics and data about military systems stored within SimR. This will include developing intuitive visualisations of capabilities that are easy to digest for inexperienced users.</li> <li>Further enhance the user interface (UI) of the SimR tool allowing it to be more intuitive and streamlined. The focus will be on a more illustrative approach rather than a textual based interface.</li> </ul>									<ul style="list-style-type: none"> <li>Java/Scala</li> <li>Javascript/JQuery</li> <li>HTML/CSS</li> <li>VUE.js</li> <li>HTTP/REST</li> </ul>
Land Capability Analysis	Edinburgh (SA)	AI Enabled War-gaming	In order to support the force design process, the Land Capabilities Analysis (LCA) MSTC at DSTG delivers S&T that uses constructive and war-gaming simulation-based capabilities to assess the performance of components of the land force in various scenarios of interest. The entities that are represented in these simulations are usually programmed with well-defined rules of movement and engagement with encountered enemies. These behavioural rules are validated by subject matter expertise for both blue and red teams in the scenario of relevance.									<ul style="list-style-type: none"> <li>Modelling skills, software development</li> <li>Excellent computer, verbal and written communications skills are required to undertake this project.</li> <li>General software development skills, scripting, source control configuration management.</li> <li>Good communication skills, Ability to work in teams, Motivated and goal-focussed</li> </ul>
Strategic Capability Analysis	Fairbairn (ACT)	Modelling and Simulation (M&S) for analysis of future operating concepts	Force Design in the ADF relies heavily on qualitative approaches such as war-gaming. While the approach has merit, it is challenged by the increasing complexity of modern operations. This project explores how simulation based analysis can support force design decision making by quantifying relative capability value.									<ul style="list-style-type: none"> <li>Modelling skills, software development</li> </ul>
Cyber Assurance and Operations	Edinburgh (SA)	Practical Adversarial Machine Learning	<p>Adversarial machine learning (AML) aims to disrupt the effectiveness of machine learning techniques that are being used in increasingly more areas of everyday life. This project will study the effects of adversarial machine learning techniques in an application domain with relevance to Defence (negotiable with the student, for example, cyber security) and develop defences against potential malicious actors using AML.</p> <p>The main objective of this project is to explore a domain of interest to determine the susceptibility of existing machine learning models to adversarial machine learning techniques. The secondary objective of this project is to develop measures to make the affected machine learning algorithms more robust and defend against adversarial influences.</p>									<ul style="list-style-type: none"> <li>Excellent computer and software development skills</li> <li>Willing to learn concepts of computer security and machine learning</li> <li>Basic understanding of research methodologies</li> <li>Good verbal and written communication skills</li> <li>Ability to work in teams and independently</li> </ul>





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
Aircraft Health & Sustainment	Fishermans Bend (VIC)	Degradation of Advanced materials in severe environments	The successful IEP applicant will be expected to be a significant contributor to a research program investigating the degradation of aircraft engines operating in harsh environments (e.g. deserts). Operation in sandy/dusty environments can lead to erosion, hot corrosion, and degradation of ceramic coatings and blockages of cooling channels. This increases the costs of operating the aircraft in the environments significantly. The successful applicant will be an integral member of a small multi-disciplinary team working on scoping the extent of the ingestion problem for the ADF. They will assess components to determine the mechanisms of degradation and evaluate potential mitigation strategies. The role will involve interacting with Australian and international project participants and there will be the opportunity to develop written and oral presentation skills via teleconferences and presentation of scientific findings at an Australian conference and/or technical meetings. The successful applicant will develop specific skills in nickel based superalloys, thermal barrier coatings, data analysis, electron microscopy and synchrotron science.									
Aircraft Performance and Survivability	Edinburgh (SA)	Cognitive Navigation in Uninhabited Ground-based and Aerial Systems	Accompanying the increasing pervasiveness of autonomous systems in our lives is the need to instil in these systems advanced reasoning and intelligence capabilities; so that they may operate with increasing autonomy, resilience and effectiveness in the real world. DST Group is interested in developing a machine cognition capability to enable an aerial autonomous system to navigate with precision in a dynamic and unpredictable environment. Armed with a set of navigation techniques at its disposal, the autonomous agent must intelligently decide which one to use in a particular situation so that it can navigate with precision to its intended target. The successful IEP applicant will be a significant contributor to this research program. The applicant will help develop and evaluate Machine Learning algorithms that provide an autonomous system with an advanced and adaptive decision making capability. The successful applicant will also conduct experiments involving ground-based robots and aerial platforms to verify the efficacy of these algorithms. The successful applicant must have excellent interpersonal and written communication skills as well as a range of technical skills. The applicant will have skills in software development, ideally with the Python, Java and/or C++ programming language(s). They will also work in a team with other IEP applicants on common technical work. The role will provide the successful application with opportunities to develop their written and oral presentation skills through presentations at technical meetings, forums and conferences.									<ul style="list-style-type: none"> <li>Software development, computer science and robotics.</li> <li>Experience in the Python and/or C++ programming languages</li> <li>Strong academic results and the ability to work independently and as team</li> </ul>
Aircraft Performance and Survivability	Edinburgh (SA)	Training robot swarms for autonomous cooperative surveillance	Autonomous Uninhabited Aerial Systems can assist with much of the dull, dirty and dangerous work faced by military personnel. Swarms of such platforms could further increase the efficiency, mass and effect of a single platform. Recent advances in multi-agent machine learning architectures have made it possible to teach swarms cooperative behaviour to perform specific missions. As part of the Aerial Autonomous Systems group, the successful IEP applicant will contribute to the design, development and validation of these architectures to perform cooperative, multi-agent surveillance tasks. Research components of the role include examining the effect of poor wireless communications and location quality on learned agent behaviour caused by cluttered and contested radio-frequency environments. Technical aspects of the role include the programming of, and experimentation with, small ground and aerial robotic vehicles to verify the efficacy of these algorithms. The successful applicant must have excellent interpersonal and written communication skills as well as a range of technical skills. The applicant will have skills in software development, ideally with the Python, Java and/or C++ programming language(s). They will also work in a team with other IEP applicants on common technical work. The role will provide the successful application with opportunities to develop their written and oral presentation skills through presentations at technical meetings, forums and conferences									<ul style="list-style-type: none"> <li>Software development, computer science and robotics.</li> <li>Experience in the python and/or c++ programming languages (and the ROS and Gazebo packages).</li> <li>Strong academic results and the ability to work independently and as team.</li> </ul>
Aircraft Performance and Survivability	Fishermans Bend (VIC)	Autonomous Vehicles Operating in Complex Environments	The Defence Science and Technology (DST) Group is conducting research on the use of teams of autonomous aircraft in urban terrain, including indoor environments. The research has the goal of developing machine-cognition technologies and demonstrating them in conjunction with new sensors to enable collaborative missions for intelligence, surveillance, and tracking; and humanitarian assistance and disaster relief in complex, congested and potentially contested environments. Two students are sought to assist with the development and demonstration of robotic teaming/swarming and unique sensing capabilities (e.g. embedded radar systems). The students will work in a multi-disciplinary team of DST staff, academic collaborators, and other students.									<ul style="list-style-type: none"> <li>Electro-mechanical design</li> <li>Laboratory experimentation</li> <li>Control-system development and testing</li> <li>Data analysis</li> <li>Programming (e.g. in C++, ROS and MATLAB)</li> <li>Report writing</li> <li>Final placement</li> </ul>

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
Aircraft Structures	Fishermans Bend (VIC)	Novel Methods in Aircraft Loads Measurement	To ensure the continued airworthiness of military aircraft it is necessary to quantify the forces (aerodynamic, inertial, etc) which are encountered by operational military aircraft. DST Group is interested in developing and applying novel flight test calibration methodologies to predict in-flight aircraft loading, with a view to replacing expensive ground based testing. During this 12 month project, the successful IEP applicant will be an integral member of a small multi-disciplinary team undertaking research into this topic. It is expected that this project will tie in with existing ongoing research into the use of neural networks for aircraft load prediction. The research will require analysis of experimental data collected from both flight and ground testing to develop new experimental methods and theories. Reporting on this work will also be required. The candidate must have excellent interpersonal and written communication skills as well as a range of technical skills. The applicant will be expected to have existing technical skills in the following domains; development of physical/mathematical models, statistical analysis, data mining and computer programming (Matlab preferred). The role will involve interacting with Australian and international collaborative partners and there will be the opportunities to develop written and oral presentation skills through presentation at technical meeting, forums and conferences.									<p>The candidate should have a good understanding and interest in the following technical disciplines:</p> <ul style="list-style-type: none"> <li>Aerospace engineering, physical/mathematical modelling,</li> <li>Statistical analysis, data mining and computer programming.</li> <li>Experience with MATLAB or similar is essential.</li> <li>Excellent verbal and written communication skills are required to undertake this project.</li> </ul>
Aircraft Structures	Fishermans Bend (VIC)	Its Easigro its good: Fatigue lives prediction tool	The successful IEP applicant will be expected to be a significant contributor to the development and verification of of an aircraft fatigue life prediction tool (Easigro). Failure of aircraft through fatigue is insidious, leading to loss of military capability and lives. DST has developed indigenous tools to predict the lives of aircraft structures as operated by Defence. The successful applicant will work with a small, multi-disciplinary team to develop and mature tools based on DST research in the areas of metal fatigue. The applicant will be expected to have some existing technical skills in the following domains: structural analyses and metal fatigue. Domain knowledge in Aerospace engineering is desirable.									<ul style="list-style-type: none"> <li>The candidate should have a good knowledge of structural analyses and metal fatigue.</li> <li>Programming skills in python desirable.</li> </ul>
Aircraft Structures	Fishermans Bend (VIC)	Developing AI for Structural Test Control System Technology	<p>The successful IEP applicant will contribute to the development and testing of AI techniques applicable to existing control system technology used for structural testing research work related to Aircraft Structural Integrity.</p> <p>One program at DST where this technology is used is with the Helicopter Advanced Fatigue Test –Test Demonstrator (HAFT-TD). Information about this program can be found at the following websites:</p> <p><a href="https://www.dst.defence.gov.au/publication/demonstrating-viability-full-scale-fatigue-testing-helicopters">https://www.dst.defence.gov.au/publication/demonstrating-viability-full-scale-fatigue-testing-helicopters</a> and <a href="https://www.dst.defence.gov.au/news/2018/04/26/innovative-australian-technologies-be-tested-us-helicopter">https://www.dst.defence.gov.au/news/2018/04/26/innovative-australian-technologies-be-tested-us-helicopter</a>.</p> <p>The role will involve assisting DST staff in a laboratory evaluation of this technology.</p> <p>The successful applicant will work with laboratory test and instrumentation equipment along with using Matlab, MTS Systems AeroProTM Control and Data Acquisition software and test controller hardware system. There will also include some work with an Automated Test &amp; Structural-dynamic Simulation System. (QanTIM® Service Load simulation software and a CaTs3 Control Cube Digital Servo-controller).</p> <p>The tasks will include experimental investigation of control system performance using AI techniques and also designing and developing hardware and software solutions to validate operation of the technology with a cantilever beam demonstration in laboratory. The successful applicant will have opportunities to present their work and knowledge in this area.</p>								<ul style="list-style-type: none"> <li>The candidate should have a good understanding of and interest in AI and control system technology (e.g. set up test control equipment for running structural test experiments).</li> <li>The candidate should be well versed in: Control system theory, computer programming, other software applications (e.g. MATLAB), and real time operating systems.</li> </ul>	
Aircraft Structures	Fishermans Bend (VIC)	Novel Methods in Spectrum Editing for Full Scale Fatigue Testing of Helicopter Structures	The successful IEP applicant will be expected to be a significant contributor to the development of loads spectrum editing tools for application to aircraft structural full scale fatigue tests, with an emphasis on helicopter testing. Full scale fatigue tests (FSFT) are key inputs for ensuring the ongoing airworthiness and sustainment of military aircraft. While FSFT technologies are mature for fixed-wing aircraft, their application to helicopter structures has been limited. DST aims to further mature these technologies such that helicopter FSFTs become a viable option for airframe fleet managers in the future. The successful applicant will work with a small, multi-disciplinary team to develop and mature tools spectrum processing tools based on DST research in the areas of fatigue spectrum generation, spectrum editing and damage estimation. The candidate must have excellent interpersonal and written communication skills as well as a range of technical skills. The applicant will be expected to have existing technical skills in the following domains: computer science Inc. programming in one or more of the following languages: python, java, c++; software engineering, database design and management. Domain knowledge in Aerospace engineering is desirable.									<p>The candidate should have a good understanding and interest in the following technical disciplines:</p> <ul style="list-style-type: none"> <li>Computer programming, software development, database management, big data.</li> </ul> <p>The candidate should be skilled in one of the following programming languages:</p> <ul style="list-style-type: none"> <li>Python, java or c++ is essential</li> <li>Excellent verbal and written communication skills are required to undertake this project.</li> <li>Domain knowledge or a keen interest in Aerospace engineering is desirable.</li> </ul>

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
Aircraft Structures	Fishermans Bend (VIC)	A Generalised Machine Learning Framework for Pattern Recognition of Combat Aircraft Systems	The main objective of this IEP will be to develop a generalised Machine Learning framework for multi-purpose space reduction and pattern recognition programs. These programs will be used for Aircraft Structural Integrity domain workflows, e.g. Computer vision for Automated Quantitative Fractography, Document and Text Analytics, Dimensionality reduction of strain gauge data, etc. In this project we are aiming to incorporate unsupervised, supervised and Deep-learning approaches towards the patterns recognition and identification problem. Patterns of interests may vary application to application but the underlying Machine Learning statistical approaches remain the same. The research challenge in this project will be to identify the need of the most appropriate machine learning approach for a given set of a data and problem. Upon understanding the need of an appropriate machine learning algorithm, the framework must either adapt towards the goal or give options to the human-in-the loop to apply the most appropriate machine learning methodology.									<ul style="list-style-type: none"> <li>The candidate should be motivated and have an understanding of applying machine learning approaches to heterogeneous data sets (i.e. Imagery and texts).</li> <li>Good computer vision and programming skills in two or more of the languages is required, e.g. Python, Matlab, C++.</li> <li>Computer Graphics and exposure to OpenGL will be a plus.</li> </ul>
Aircraft Structures	Fishermans Bend (VIC)	Augmented Reality GUI for aircraft maintenance activities	The primary objective for this IEP student shall be to develop a graphical user interface (GUI) for a platform agnostic augmented reality system that will complement other work in 3D model development and open source database query architecture. The aim of the student shall be to create a user friendly interface with any back end database that shall enable an end user to interact with said data, visually overlay that data onto a 3D model of the real world in the field of view of the user. The GUI shall enhance the end user understanding of the real environment and allow the user to create new data that is then stored back into the back end database. The short term aim of this work is a product demonstration for use in the up-coming HAFT-TD and/or C-27J fatigue test.									<p>The candidate should have a good understanding and interest in the following technical disciplines:</p> <ul style="list-style-type: none"> <li>GUI design with Augmented Reality systems including human factors experience, data fusion and visualisation techniques, programming for Unity, Unreal Engine, SQL.</li> <li>Excellent verbal and written communication skills are required to undertake this project.</li> </ul>
Airframe Technology & Safety	Fishermans Bend (VIC)	Forensic Science Investigations of Australian Defence Force Aerospace Components and Systems	This project involves investigating failures of components and systems from Defence platforms which will contribute to the enduring Forensic Science and Accident Investigation capability. The position is a unique opportunity to be a part of DST's Aerospace Metallic Technology group working with Engineers and Scientists in priority incident investigations associated with Royal Australian Air Force aircraft components and systems. Throughout this placement, a broad range of laboratory and forensic skills will be developed covering many aspects of an aircraft investigation, including contributing to preliminary investigation reports and assisting in writing final factual reports.									<p>The candidate should be:</p> <ul style="list-style-type: none"> <li>Familiar with materials assessment.</li> <li>Familiar with fracture surface interpretation.</li> <li>Excellent computer, verbal and written communications skills and the ability to work in teams are required to undertake this project.</li> </ul>
Airframe Technology & Safety	Fishermans Bend (VIC)	Evaluation of selected probabilistic methods for composite structural integrity assessment	With more and more aircraft of composite structures entering service in the Australian Defence Force, there is a pressing need to develop robust methods for reliably assessing and managing the integrity of composite structures. As composite structures are prone to high level of scatter in mechanical properties, probabilistic approaches warrant particular attention and much research has been conducted. This project aims to evaluate selected probabilistic methods, in the context of specific composite systems and operating environment conditions of the Royal Australian Air Force (RAAF) fleet.									<p>The candidate should have a good understanding and interest in the following technical disciplines:</p> <ul style="list-style-type: none"> <li>Modelling and software development</li> <li>Structural and damage mechanics for composites</li> <li>Probabilistic analysis.</li> <li>Excellent verbal and written communication skills are required to undertake this project.</li> <li>Domain knowledge or a keen interest in Aerospace engineering is desirable.</li> </ul>
Airframe Technology & Safety	Fishermans Bend (VIC)	Composite Airframes for UAVs	The successful IEP applicant will be trained in composite manufacturing processes, machining, accelerated conditioning and mechanical test procedures. It is anticipated that the work will mostly contribute to a research program in large uninhabited aerial vehicles (UAVs), but may include other programs in small UAVs, helicopters and fast jets. The student will also be given the opportunity to develop and undertake their own project.									<ul style="list-style-type: none"> <li>This position is targeted at current TAFE engineering students, working two days a week while undergoing their studies.</li> <li>It is expected that the student will be enrolled in mechanical or aerospace engineering or a related field.</li> </ul>

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
Airframe Technology & Safety	Fishermans Bend (VIC)	Assessment of Composite Armour Plates	The successful IEP applicant will be working on assessment of composite armour plates, involving environmental conditioning, NDI inspection and mechanical testing. The project will start with detailed task planning. Periodic project progress reports and completion of a detailed technical report at the end of the project are required. Training and supervision will be provided.									<p>The knowledge and skills in following areas will be desirable:</p> <ul style="list-style-type: none"> <li>• Composite materials, non-destructive inspection, environmental conditioning and mechanical testing.</li> <li>• Task planning and report preparation and essential for this project.</li> </ul>