**Australian Government**
**Department of Defence**
Science and Technology

# DST Industry Experience Placement Program

## 2021

## Potential Industry Experience Placement Projects

### List of Abbreviations

| Division | Abbreviation |
|---|---|
| Air Division | AD |
| Cyber and Electronic Warfare Division | CEWD |
| Intelligence Surveillance and Space Division | ISSD |
| Joint Operations and Analysis Division | JOAD |
| Land Division | LD |
| Maritime Division | MD |
| Weapons and Combat Systems Division | WCSD |

| Research Stream | Abbreviation |
|---|---|
| Aerospace / Aeronautical Engineering, Naval Architecture Stream | AAENA |
| Chemical, Radiological, Biological, Food Sciences Stream | CRBFS |
| Computer Sciences, IT, Software Engineering, Telecommunications Stream | CSITSET |
| Electronic / Electrical Engineering Stream | EEE |
| Materials Science Stream | MS |
| Mathematics and Physics Stream | MP |
| Mechanical and Mechatronic Engineering (including Robotics) Stream | MMER |
| Psychology and Social Sciences Stream | PSS |

| Location | Division | Project Title | Project description | Desirable Skills | AAENA | CRBFS | CSITSET | EEE | MS | MP | MMER | PSS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Edinburgh, South Australia | AD | Resilient flight of Nano/Micro scale drones using biologically-inspired control techniques and evolutionary design | To date, nature has provided exemplars that consistently outperform man-made aerial systems. These biological platforms are capable of amazing agility, level gliding flight and hovering. Further they are able to maintain these abilities through their lives demonstrating robustness to damage and immunity to environmental disturbances. This performance can be attributed to an advanced control system as well as years of "re-design" through evolution.<br>The Resilient Flight Control (RFC) program explores the implementation of these biological and evolutionary algorithms to the design and control of nano/micro scale platforms that are of benefit to the Australian Defence Force. The objective of the RFC program is to develop "Learning" and "Thinking" aerial platforms which are robust to:<br>1. damage or defects<br>2. Unanticipated disturbances from environmental or commanded influences<br>3. coping with previously untried vehicle configurations – be they fixed-wing, rotary-wing and actuated aircraft systems<br>The successful applicant will be responsible for supporting the design of novel flight controllers, integration of these flight controllers onto nano/micro scale drones, flight testing and re-iterating. One of the objectives will be a flight demonstration relevant to the current strategic thrusts. | • Experimental skills<br>• Ability to work in teams<br>• Motivated and goal-oriented<br>• Basic software development skills desirable but not necessary<br>• Previous research experience desirable but not necessary | Y | | | | | | Y | |
| Edinburgh, South Australia | AD | Training robot swarms for autonomous cooperative surveillance and sensing | Autonomous Uninhabited Aerial Systems (UASs) 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 Autonomy group, the successful IEP applicant will contribute to the design, development and validation of these architectures to perform cooperative, multi-agent surveillance and sensing tasks.<br>Research components of the role may include designing multi-agent swarm algorithms for cooperative surveillance and environmental sensing, and the application of visual object detection algorithms. Technical aspects of the role may include the building, programming and experimentation with small rotary and fixed-wing UAS. Experiments may take place onsite at DST Edinburgh or at other experimental test ranges such as the Woomera Test Range.<br>The applicant will have skills in software development and a familiarity with the Python scripting language and the Linux (Ubuntu) environment. Previous experience with robotics, UAS and workshop skills are desirable but can be developed through on-the-job training. The role will provide the successful applicant with opportunities to develop their written and oral presentation skills through presentations at technical meetings, forums and conferences. The successful applicant must have excellent interpersonal skills and due to the current pandemic, the ability to work independently from home. | • Experience in the Python scripting language and familiarity with Linux (Ubuntu)<br>• Software development, computer science and robotics<br>• Knowledge or interest in swarm algorithms and/or machine learning<br>• Strong academic results and the ability to work independently and as a team | | | Y | Y | | | Y | |
| Fishermans Bend, Victoria | AD | Battle Damage Repair | Airfoils, either as blades or blisks, will vibrate during engine operation. The frequency of this vibration can vary from hundreds to thousands of Hz. Due to the high frequency of vibration cyclic damage is rapidly accumulated result in component failure. This mechanism is generally known as high cycle fatigue (HCF).<br>The aim of this program is to evaluate the efficacy of airfoil repair by assessing the condition of an airfoil before and after being repaired. | • Understanding of the physical behaviour of an airfoil during vibration<br>• Experimental skills in electromechanical shakers and/or Laser Vibrometry | Y | | | | Y | Y | Y | |
| Fishermans Bend, Victoria | AD | Hot Corrosion and the Debit on Life | Blade release has resulted from hot corrosion initiated fatigue in multiple platforms in the ADF This project aims to address how much fatigue life debit occurs to gas turbine blades when they operate in such extreme environments. It involves failure analysis of the degraded blades, defining and running a thermo-mechanical test plan, and using the results to estimate the life debit. | • Experimental skills<br>• Materials and mechanical testing<br>• Microscopy<br>• Good communication skills<br>• Ability to work in teams | Y | | | | Y | | Y | |
| Fishermans Bend, Victoria | AD | *AI development for Structural Test Control System Technology* | The successful IEP applicant will contribute to the ongoing development and testing of AI techniques applicable to existing control system technology used for structural testing research work related to Aircraft Structural Integrity. The work program will involve development of predictive and perceptual type methodologies applicable to a control system.<br>One program at DST where this technology would be beneficial is with the Helicopter Advanced Fatigue Test –Test Demonstrator (HAFT-TD). Information about this program can be found at the following website:<br>https://www.dst.defence.gov.au/publication/demonstrating-viability-full-scale-fatigue-testing-helicopters<br>The role will involve collaborating with DST research engineers and scientists in a laboratory evaluation of this technology. 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 and other development tools available.<br>The tasks will include experimental investigation and evaluation of control system performance | • Good understanding of and interest in AI applications and control system technology (e.g. set up test control equipment for running structural test experiments)<br>• Control system theory<br>• Computer programming, other software applications (e.g. MATLAB), real time operating systems<br>• Knowledge and work involving the use of AI for practical applications would be beneficial<br>• Good communication skills, enjoy working in teams, be self-motivated and goal-focussed | | | | Y | | | Y | |

| Location | Division | Project Title | Project description | Desirable Skills | AAENA | CRBFS | CSITSET | EEE | MS | MP | MMER | PSS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | using AI techniques and also designing, developing hardware and software solutions to validate operation of the technology with a cantilever beam type demonstrator.. The successful applicant will have opportunities to present their work and knowledge in this area. | | | | | | | | | |
| Fishermans Bend, Victoria | AD | Forensic Engineering Investigations of Australian Defence Force Aerospace Components and Systems, and Additive Manufacturing research | This project involves investigating failures of components and systems from Defence platforms which will contribute to the enduring Forensic Engineering and Accident Investigation capability. The position is a unique opportunity to be working with Engineers and Scientists in priority incident investigations associated with military aircraft components and systems. The placement will also expose the student to current research in Additive Manufacturing. Throughout this placement, a broad range of laboratory, forensic and research skills will be developed, exposure to military aircraft and components, assisting in writing investigation reports and research papers, and interacting with military clients. | • Familiar with materials assessment<br>• Familiar with fracture surface interpretation<br>• Excellent computer, verbal and written communications skills<br>• Ability to work in teams | Y | | | | Y | | | |
| Fishermans Bend, Victoria | AD | Forensic Microscope Imaging Suite MacOS scripts/software to WinOS Transition Software Development, and Local Corporate Database Enhancement | This placement will involve two projects requiring a highly talented student in the field of IT. The first project requires the development of software and scripts for the transition of Apple MacOS assets that currently have scripts/software developed to control scientific equipment for forensic investigations, to Windows OS assets. Parallel processing trials during the development with existing assets will ensure data integrity.<br>The second project will provide an opportunity to introduce modern enhancements of the local corporate database, updating and enhancing AD's web presence and automating basic processing functions. | • Software development, scripting, knowledge of MacOS, WinOS, Java | | | Y | | | | | |
| Fishermans Bend, Victoria | AD | Vibration Energy Harvesting for Air Vehicles | The successful IEP applicant will be expected to be a significant contributor to a programme of research investigating potential diagnostic health monitoring systems for use on Australian Defence Force air vehicles. In particular, the successful applicant will be involved in the development of techniques for parasitic energy harvesting from vibrating aircraft structures. These energy harvesting devices should be capable of harvesting power from aircraft vibrations using novel piezoelectric materials, with the goal of powering for example Condition Based Maintenance devices for material state awareness. Tasks include mechanical and electronic design, code/script development, model development, and experimental validation. The experimental studies will require taking measurements under laboratory conditions and then analysing the data where necessary and reporting on the findings. The applicant can expect to develop various specific skills during the 12 month posting e.g. MatlabTM scripting may be used for COMSOLTM finite element multiphysics modelling. MatlabTM and/or PythonTM may also be used for automation of various laboratory tests. SolidworksTM may be used for the development of mechanical design ideas for 3D printing of devices. The applicant may be exposed to C, C++, required for low power embedded microcontrollers, and high power Digital Signal Processing. Additionally, the applicant has the option of developing their technical communication skills by presenting their research findings at an Australian scientific/engineering conference. | • Mechanical and electronic design<br>• Code/script development<br>• Model development<br>• Experimental validation | Y | | Y | Y | Y | Y | Y | |
| Fishermans Bend, Victoria | AD | Fibre optic sensing for Defence platforms | The successful IEP applicant will be a significant contributor to a critical programme of research investigating potential health monitoring systems for the RAAF's new aircraft capability.<br>Technical Background: Current electrical strain gauge technologies are time consuming to install and for high density strain surveys can add considerable weight to the structure under test due to the associated wiring. These gauges are also prone to fatigue and require continual calibration when installed on operational aircraft. Optical fibre based sensing systems present the opportunity to significantly reduce installation complexity and weight since strain sensing is distributed along a single optical fibre with a cross section approximating the dimensions of a human hair. These sensing systems are insensitive to EMI, fatigue and corrosion resistant and do not require ongoing calibration. In addition, the potential savings for full scale fatigue testing, where large numbers of strain gauges are required, is significant.<br>Project Aim: This project will evaluate the suitability of a recently developed fibre optic strain sensing system for application to Australian Defence platforms. | • Experimental skills and analysis, excellent record keeping and attention to detail<br>• Experience with CAD or finite element software packages and Matlab or equivalent<br>• Excellent computer, verbal and written communications skills<br>• Ability to work in teams and individually<br>• Motivated and goal-focussed, self-starter, problem-solving skills | Y | | | | Y | Y | | |
| Fishermans Bend, Victoria | AD | Advanced sensing technologies for Additively Manufactured coupons & components | The successful IEP applicant will be a significant contributor to a critical programme of research characterising the structural response of additively manufactured coupons and components using fibre optic sensing technology.<br>Technical background: 3D printing of metallic aerospace components is an exciting new field in Defence. The ability to predict and characterise the structural response of components with advanced sensing technologies is crucial to validating computational models and mechanical test results manufacturing fit-for-purpose, certified, metallic parts, anytime, anywhere.<br>The DST Material State Awareness Group have developed several advanced sensing technologies that could contribute to this capability. The student will trial distributed strain sensing fibre optics to: detect and locate strain hotspots associated with manufacturing flaws that could result in component/coupon failure; and, characterise the structural response of additively | • Experimental skills and analysis, excellent record keeping and attention to detail<br>• Experience with CAD or finite element software packages and Matlab or equivalent<br>• Excellent computer, verbal and written communications skills<br>• Ability to work in teams and individually<br>• Motivated and goal-focussed, self-starter, problem-solving skills | Y | | | | Y | Y | Y | |

| Location | Division | Project Title | Project description | Desirable Skills | Research Streams | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | PSS | | | AAENA | CRBFS | CSITSET | EEE | MS | MP | MMER | PSS |
| | | | manufactured coupons and components. <br> The student will evaluate and report on the quality and reliability of the sensing technology. | | | | | | | | | |
| Fishermans Bend, Victoria | AD | Robotic Inspection of Aerospace Composite Structures | The successful IEP applicant will contribute to the development and testing of a new technology for ground and aerial based robotic inspection of advanced composite based aerospace structures. This is a multidisciplinary project which brings together concepts in robotics and mechatronics, with materials science and advanced multi-spectral sensing to create a new capability for rapid diagnostic inspection of critical aerospace components, including wings and control surfaces.  As the successful applicant you will work in a supportive team environment with a diverse and multi-skilled group of DST scientists on the development and testing of ground and aerial robots, the integration of advanced visual and IR imaging sensor systems and associated software, and in the test and evaluation of these robotic systems on full scale aircraft components. This project will appeal to students with interests in one or more of the following: robotics, mechatronics, advanced sensors, programming, and materials science.  Through your involvement you will acquire new skills in a range of advanced experimental and computational tools and methods, an exposure to cutting edge R&D, and an opportunity to hone your communication skills by contributing to publications and presentations stemming from your work. | • Interest and skills in one or more of the following: <br>   o   Robotics <br>   o   Mechatronics <br>   o   Sensors <br>   o   Programming <br>   o   Software development <br>   o   Materials science | Y | | Y | Y | Y | Y | Y | |
| Fishermans Bend, Victoria | AD | Big Data for Material State Awareness | The successful IEP applicant will contribute to the development of a new capability in sensor enabled big data for material state awareness.  This important new capability builds on previous development of a compact low-cost stress imaging solution which was successfully deployed on the F-35 full scale structural test program in the US and the UK (see https://www.dst.defence.gov.au/opportunity/mite for further information).  The next tranche of this technology involves a miniature imaging sensor package with integrated intelligence and wireless data transfer.  The aim of this project is to deploy this novel sensor package on mass in a surveillance web to create a real-time high-fidelity full-coverage material state awareness capability for structurally critical aerospace components.  As the successful applicant you will work in a supportive team environment with DST scientists and industry representatives on the development, testing and industry transition of this capability.   While the project is broad in scope it would appeal most to those with an interest in one or more of the following: image processing and manipulation, data analytics, big data, advanced sensors, and programming.  Through your involvement you will acquire new skills in a range of advanced experimental and computational tools and methods, an exposure to cutting edge R&D and its transition to industry, and an opportunity to hone your communication skills by contributing to publications and presentations stemming from your work. | • Interest and skills in one or more of the following: <br>   o   Image processing and manipulation <br>   o   Data analytics <br>   o   Big data <br>   o   Sensors and programming <br>   o   Software development. | Y | | Y | Y | | Y | Y | |
| Fishermans Bend, Victoria | AD | Space Vehicle Development | DST has a number of Science and Technology Space Research programs including the Resilient Multi-mission Space STaR Shot which aims to develop advanced technologies for a constellation of small (~150kg) satellites in Low Earth Orbit to meet defence needs. The Aerospace Division (AD) is currently growing its capabilities in a number of areas to support these programs including advanced multifunctional materials; advanced and deployable structures; and mechatronics. <br> The selected student will work in one of these capability areas developing advanced technologies and structures for a "resilient" satellite, able to survive in a contested and congested environment. | • Required: <br>   o   Experience in: problem analysis, design, modelling, manufacturing/prototyping, and testing <br>   o   Excellent verbal and written communications skills <br>   o   Ability to work both independently and in teams <br>   o   Motivated and goal-focussed <br> • Experience in (at least one): <br>   o   advanced materials <br>   o   additive manufacturing <br>   o   control systems and actuation <br>   o   satellite design <br>   o   structural analysis <br>   o   thermal analysis <br>   o   satellite design <br> • Desirable: <br>   o   Knowledge of requirements and considerations when designing/testing for Space applications (e.g. environmental considerations and testing requirements) <br>   o   Understanding of satellite operations <br> • Understanding of Australian/International Space Industry | Y | | | Y | Y | Y | Y | |

| Location | Division | Project Title | Project description | Desirable Skills | Research Streams | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AAENA | CRBFS | CSITSET | EEE | MS | MP | MMER | PSS |
| Fishermans Bend, Victoria | AD | Aerospace Digital Twin Exploration and Applications | Digital twins are virtual representations of physical components, platforms, systems or processes that enable game changing impacts in how we design, sustain and operate our aerospace systems. The successful IEP candidate will work within the Aerospace Division Digital Twin team to explore the current state of the art in space related Digital Twin technology, and develop proof of concept technology demonstrations in support of space domain applications. | • Excellent written and verbal communication skills and be motivated with a strong ability to work in teams<br>• Experience in modelling and simulation<br>• General software development skills including scripting, and source control management | Y | | Y | | | | Y | |
| Fishermans Bend, Victoria | AD | Augmented Reality Graphic User Interface Design & Evaluation for Aircraft Maintenance | The primary objective for this IEP student shall be to develop a graphical user interface (GUI) using HoloLens 2 to optimise the user experience with innovative technologies associated with the hardware (e.g. Gesture control, eye tracking, voice recognition and controls etc.). The aim of the student shall be to create a user friendly interface between the HoloLens 2 and a graphical database (NEO4J) that shall enable an end user to interact with aircraft data, visually overlay that data onto a 3D model of a real aircraft on the ground 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 graphical database. This activity will build upon work already underway at DST, and will be an important part of AD research efforts in the field of AR and HMI. | • GUI design with Augmented Reality systems including human factors experience, data fusion and visualisation techniques, programming for Unity, Unreal Engine, SQL<br>• Excellent verbal and written communication skills | Y | | Y | | | | Y | Y |
| Fishermans Bend, Victoria | AD | Design and Analysis of a Pressure Transducer Dynamic Calibration Rig | The measurement of unsteady (i.e. fluctuating) aerodynamic pressure is a key capability of Experimental Aerodynamics (EA) discipline at DST Group. Often, specialised pressure transducers are used for these types of measurements, but the transducers need to be dynamically calibrated prior to usage, to understand whether the measurements are affected by the transducer frequency response characteristics. Therefore, the aim of this project is to design and analyse a dynamic calibration rig that is fit-for-purpose for the transducers used within EA. This project will present an exciting and hands-on learning experience for the candidate, but will also be an opportunity to contribute to a key capability of EA. | • Experimental skills ("hands-on" skills, ability to conduct literature survey and formulate an approach to solving a problem)<br>• General software development skills (MATLAB, Python, C/C++, etc.)<br>• Good understanding of signals acquisition and processing<br>• Ability to work under limited guidance and supervision<br>• Good written and oral communication skills | Y | | | | | Y | Y | |
| Fishermans Bend, Victoria | AD | Optimisation of Unmanned Aerial System Hardware Dynamics for Disturbance Control | Unmanned Aerial Systems (UAS) with mission specific payloads are required to operate in challenging environments, including in high levels of atmospheric turbulence and to withstand varying degrees of damage. Operating in these environments requires high degrees of control resilience, which is the focus of the DST Trusted Autonomous Systems' Resilient Flight Control (RFC) program through researching advanced flight control methods for UAS. Disturbance rejection is a measure of aircraft resilience; and therefore, maximising this capability is a key goal of the RFC program. UAS hardware systems can fundamentally constrain the capability of disturbance rejection algorithms, and consequently, hardware considerations must be addressed when optimising a vehicle's disturbance rejection performance. To this end, the RFC project is:<br>- Evaluating the performance of a range of UAS hardware - including motors, ESC's and sensors - to develop accurate component level dynamic models<br>- Integrating system models into existing flight control optimisation codes to evaluate the effect of different hardware on a range of performance metrics<br>- Conducting flight tests of optimised UAS to demonstrate superior disturbance rejection characteristics<br>The successful applicant will be responsible for evaluating UAS hardware to identify dynamic system models through analysis and experimentation; analysis of experimental data for flight control optimisation, and supporting flight testing of optimised UAS . | • Experimental skills<br>• Data analysis skills<br>• Flight control experience<br>• Software development experience<br>• Familiarity with ArduPilot desirable | Y | | Y | | | | Y | |
| Fishermans Bend, Victoria | AD | Autonomous Vehicles Operating in Complex Environments (2 positions) | The Defence Science and Technology (DST) Group is conducting research on the use of autonomous aircraft and ground robots in urban terrain, including indoor environments. The research has the goal of developing machine-cognition technologies and them demonstrating in conjunction with new sensing to enable missions for intelligence, surveillance, and reconnaissance; contaminant-source localisation and tracking; and humanitarian assistance and disaster relief in complex, congested, and potentially contested environments. Two students are sought to assist with simulation-based and laboratory testing of autonomous search and mapping algorithms, robotic teaming, etc. The students will work directly with DST Group staff to carry out the laboratory components of this project and will work largely independently to carry out its non-laboratory components.<br>The project activities will require the students:<br>1. To design and build robotic systems capable of operating in the challenging conditions of an urban environment<br>2. To create simulations of robotic systems performing exploratory and search missions<br>3. To demonstrate the resulting systems in representative indoor and outdoor trials facilities<br>Activities will include:<br>1. Programming (e.g., in C++, ROS, and MATLAB)<br>2. Control-system development and testing | • Software development, computer science and robotics<br>• Strong academic results<br>• Ability to work independently and as a team. | | | Y | Y | | | Y | |

| Location | Division | Project Title | Project description | Desirable Skills | Research Streams | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AAENA | CRBFS | CSITSET | EEE | MS | MP | MMER | PSS |
| | | | 3. Electro-mechanical design<br>4. Laboratory experimentation<br>5. Data analysis<br>6. Report writing<br>7. Final placement presentation | | | | | | | | | |
| Fishermans Bend, Victoria | AD | Investigation into the Derivation of Initial Flaw Distributions for use in Aerospace Platform Lifing | Understanding the build quality of an aerospace structure is essential in managing the structural integrity of the platform. The initial flaw distribution is an essential input into probabilistic lifing approaches which has a significant impact on the determined level of risk. However, a standardised approach regarding how to define such distributions is not defined. Current methods applied can be overly conservative, but in some cases can be non-conservative resulting in an under predicted level of structure risk. This program seeks to use the high fidelity data available from a recent test program and fleet data inspections to investigate the derivation of this key input, with the aim of developing a best practice approach as well as key insights for the international community on the derivation of initial damage distributions. | • Understanding of (and interest in) the fatigue of Aerospace Structures<br>• Able to work independently as well as in a team environment | Y | | | | | | | |
| Fishermans Bend, Victoria | AD | Next-generation composite repairs | An engineering/science student will support the development of next-generation composite repairs. The successful person will work as part of a small team devising concepts and performing experiments focused on developing a robust and reliable process for:<br>(i) preparing damaged composites for repair<br>(ii) out-of-autoclave manufacture of composite patches<br>(iii) adhesively bonding the patch into the prepared parent<br>(iv) Restoring other advanced features of the parent.<br>The project will be performed in our composites laboratories and involve CNC machining, composites manufacture (lay-up, bagging and curing), mechanical testing and other advanced measurement methods. | This is an experimental project based primarily in a composites laboratory. It is essential that the person have the ability and willingness to:<br>• Perform machining, composites manufacture and mechanical testing<br>• Prior experience with these is desirable but not essential:<br>  o Comply with laboratory procedures that focus on<br>  o Workplace Health and Safety and<br>  o the reliability and reproducibility of experimental results<br>• Work within a team. | Y | | | | Y | | Y | |
| Edinburgh, South Australia | CEWD | Simulation of Cybersecurity scenarios on ad-hoc networks | A particular area where autonomous cyber systems may be more effective in the future than human security analysts is in the defence of remote distributed computer systems. In this project, the student will investigate the security of a distributed ad-hoc network. They will develop high-level models of such systems, and implement such a system within virtual infrastructure, within DST's CybORG Cyber AI Gym. These models and infrastructure will be used as a basis for the development and testing of autonomous cyber defence tools that can flexibly respond to threats. | • Software development skills including:<br>• Knowledge of Python<br>• Familiarity with Computer Security and Artificial Intelligence concepts | | | Y | | | | | |
| Edinburgh, South Australia | CEWD | Virtual users for autonomous cyber | A challenge in developing autonomous cyber defence is ensuring that an autonomous defender does not compromise the availability or utility of a computer network as part of defending it. In this project, the student will extend the CybORG cyber AI gym to add simulated users. These users will mimic the behaviour of a human user within a particular cybersecurity scenario, and return feedback as to whether normal system use is hampered or prevented. | • Software development skills including:<br>• Knowledge of Python<br>• Familiarity with Computer Security and Artificial Intelligence concepts | | | Y | | | | | |
| Edinburgh, South Australia | CEWD | Autonomous Radio Frequency Defence | The aim of this project is to employ machine learning and adaptive methods to automatically respond in a contested radio frequency spectrum. This research will involve building experience in radar processing techniques and explore novel machine learning approaches for controlling RF emitters. All techniques will be practically implemented and tested on software-defined-radio hardware. | • Experience in, or an ability to quickly learn:<br>• MATLAB, Python, GNU Radio and/or LabVIEW<br>• Skill in developing software to perform visualisation, signal processing, and implementing machine learning techniques<br>• Good experimental skills including using test equipment to perform RF testing and debugging of RF hardware<br>• Excellent written communication skills and the ability to work as part of a team | | | y | y | | y | y | |
| Edinburgh, South Australia | CEWD | Cognitive Radar Perception | The aim of this project is to further the development of a machine-learning software toolset capable of replacing human operators and legacy radar processing techniques. The toolset will enable a computer to intelligently interpret radar displays and controls to perform autonomous monitoring and radar-operation. This project will offer opportunities to explore modern machine learning techniques such as deep learning to implement leading-edge radar-processing algorithms. | • The candidate should have interest, experience & skill in most or all of the following:<br>  o Software development (particularly in MATLAB, python and/or C++)<br>  o Performing experiments<br>  o Data visualisation<br>  o Numerical modelling<br>  o Signal processing<br>  o Machine learning<br>• Can demonstrate exceptional verbal and written communication skills<br>• This research may also involve GPGPU computing | | | y | y | | y | y | |

| Location | Division | Project Title | Project description | Desirable Skills | AAENA | CRBFS | CSITSET | EEE | MS | MP | MMER | PSS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Edinburgh, South Australia | CEWD | Practical Adversarial Machine Learning | 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 AML techniques in an application domain with relevance to Defence (negotiable with the student, for example, cyber security), test and evaluate existing approaches and develop defences against potential malicious actors. Contribution to the creation of appropriate test tools and participation in AML red-teaming exercises is anticipated. | • Excellent computer and software development skills (Python)<br>• General knowledge of machine learning and willing to learn concepts of computer security<br>• Basic understanding of research methodologies<br>• Good verbal and written communication skills<br>• Ability to work in teams and independently | | | Y | | | Y | | |
| Edinburgh, South Australia | CEWD | Cognitive Modems | AI-enabled cognitive communication systems can sense and learn the operating environment and autonomously generate robust waveforms for reliable and uninterrupted communication. The proposed IEP project will focus on developing AI-enabled cognitive modems using Software-defined Radios. | • Experience in coding with Python / MATLAB / C++<br>• Some knowledge of communication theory, signal processing techniques and software-defined radios<br>• Good written and verbal communication skills<br>• Motivated and goal-focussed | | | Y | Y | | | | |
| Brisbane (University of Queensland) | CEWD | Assembly code lifting for information flow analysis | Compilers can introduce a variety of unexpected behaviours that may invalidate reasoning performed at the level of a programming language.<br>This is particularly true for properties in a concurrent setting, where synchronisation behaviours may be eliminated or modified in attempts to optimise execution performance. Consequently, it is preferable to conduct analysis over a program representation closer to the executed binary, such as the compiler's assembly output. However, it is often difficult to understand these representations due to the lack of language abstractions, such as control flow and symbols, and the introduction of architecture specific details.<br>Various frameworks have been developed to convert these low level representations into more abstract, architecture generic forms suitable for automatic analysis. This language conversion, referred to as lifting, abstracts over the low level source language to expose the behaviours of interest. Moreover, these frameworks often include additional processing stages to introduce information to assist in analysis, such as construction of a control flow graph or identification of symbols.<br>The aim of this project is to identify and potentially extend such a framework to lift a compiler's assembly output to a form suitable for an existing information flow analysis. This may involve extending the framework to ensure behaviours of interest are preserved, in addition to introducing pre-processing steps to assist the analysis. It may also involve modifying the information flow analysis to improve compatibility. | • Programming<br>• Discrete maths<br>• Good verbal and written communications skills | | | Y | | | | | |
| Brisbane (University of Queensland) | CEWD | Invariant generation for information flow security analysis | The analysis of programs is vital in the context of developing security-critical infrastructure. To develop a tool that performs such an analysis is a challenging task and one of the major issues is the handling of loops. Instead of unrolling the loop body many times during the analysis, ideally one would like to use a "summary" of a loop's behaviour instead, which sums up the "important" parts of the loop that hold in every iteration. Such a construct is referred to as loop invariant. To specify loop invariants can be challenging for a programmer. However, approaches exist to generate loop invariants automatically.<br>The aim of the project is to research the state-of-the-art for invariant generation and integrate an existing approach with our existing information flow security analysis tool. The project allows the intern to work in a collaborative environment and learn about program analysis techniques in general, and in particular, about state-of-the-art information flow security analysis. | • Programming<br>• Discrete maths<br>• Good verbal and written communications skills | | | Y | | | | | |
| Brisbane (University of Queensland) | CEWD | Automation of security analysis in a theorem prover | Automatic program analysis tools allow users to demonstrate security properties of their program with minimal initial overhead. However, as the complexity of these programs and the environments within which they execute increases, these tools become increasingly complex, potentially resulting in the introduction of bugs that may invalidate their results. Moreover, due to the focus on automation, it can be difficult to interact with these tools to assist reasoning when analysis fails.<br>Interactive theorem provers present a potential alternative approach. These tools enable the description of an executable program analysis and the verification of its abstract properties, with high correctness guarantees. However, application of the resulting analysis is often non-trivial, due to the steep learning curve associated with the provers and their execution overheard. This project investigates how automation within an interactive theorem prover can facilitate the application of a verified information flow analysis to a low-level, assembly-like language. | • Discrete maths<br>• Good verbal and written communications skills | | | Y | | | Y | | |
| Brisbane (University of Queensland) | CEWD | Simulating security vulnerabilities at the software/hardware interface | Many new software security vulnerabilities are arising at the interface of software and hardware, as more complex microprocessors are developed to increase computing power. To address and uncover such vulnerabilities, as well as mitigate against them, a deep and accurate understanding of how they arise is needed. This project will extend an existing theoretical framework and develop tools at the intersection of software and multi-core microprocessor space including a simulator/model checker, and its front-end interactive visualiser. | • Programming<br>• Discrete maths<br>• Good verbal and written communications skills | | | Y | | | | | |

| Location | Division | Project Title | Project description | Desirable Skills | AAENA | CRBFS | CSITSET | EEE | MS | MP | MMER | PSS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Research Streams | | | | | |
| Edinburgh, South Australia | CEWD | Adapting commercial antennas for Defence through novel RF techniques | Commercial antennas meet some, but often not all of the requirements unique to Defence applications. This project will look at the characterisation of commercial antennas, and techniques to adapt them to meet unique applications through techniques that involve simulation, 3D printing and advanced laser micromachining techniques | • RF engineering<br>• Antennas<br>• Computational electromagnetics<br>• CAD modelling | | | Y | Y | | Y | | |
| Edinburgh, South Australia | CEWD | Reconfigurable and Adaptive Antennas | The modern soldier is being constantly driven to achieve more in the field. To achieve this mission they are augmented by an array of modern military technology. This project will look at getting more from the equipment that a soldier is asked to carry, by making antenna system electrically reconfigurable to suit a dynamic and changing operational environment. | • RF engineering<br>• Electronics engineering<br>• Embedded software<br>• Antennas<br>• Computational electromagnetic<br>• CAD modelling | | | Y | Y | | Y | | |
| Edinburgh, South Australia | ISSD | Small Satellite Experimentation and Support to Space Operations | The Space Systems STC at DST Edinburgh is currently working on the Buccaneer Main Mission "6U CubeSat" project that is scheduled for launch in mid-2022. This project would provide an opportunity to work alongside with other Space Systems Engineers and Scientists on payload integration activities plus testing Space Communications Protocols and other RF communications sub-systems. These will include assisting in broader system level integration testing with ground station equipment and a channel emulator. In addition, there will be also be an opportunity to contribute to a niche R&D stream to explore novel communications technologies, including digital multi-beamforming algorithms and architectures to support future missions for secure Space Operations. | • It is expected that the student will have some prior programming experience using C/C++/Python/Matlab and any software defined radio (SDR) platform experience is advantageous<br>• Background knowledge in Information and Communications Technologies, Telecommunications and Signal Processing theory is preferred<br>• Strong interest to work in space and satellite technologies is essential<br>• Good written, communication and computer skills | | | Y | Y | | | | |
| Edinburgh, South Australia | ISSD | Satellite and Constellation Design Optimisation | The advent of 'new space' is seeing the rise of constellations of small satellites that can fulfil many of the roles previously reserved for large, expensive geostationary satellites. Designing these constellations is a significant challenge, particularly as there is interdependencies between the design of the satellite and the constellation shape that will result in maximum performance. This project will seek to extend DST's state-of-the-art design optimisation toolkit to include satellite systems and constellation shape design. | • Matlab Proficiency<br>• Modelling and Simulation Skills<br>• Orbital Dynamics<br>• Knowledge of Satellite Systems<br>• Applied Mathematical Optimisation (Genetic Algorithms)<br>• Communication and Teamwork skills | Y | | | | | | | |
| Edinburgh, South Australia | ISSD | Inverse Synthetic Aperture LADAR Space Target Recognition | Inverse synthetic aperture ladar (ISAL) is a very promising technology for the detection and identification of remote targets in the space environment. It acquires high-resolution images of moving targets even a very large distances and has a high imaging frame rate to record the continuous motion of the target. While the concept of ISAL is similar to inverse synthetic aperture radar (ISAR), the much shorter wavelength of light has a number of profound implications. Despite this, ISAL image processing is based on techniques used in ISAR. This project aims to develop a sparse atom decomposition technique designed specifically for ISAL which both leverages the benefits of sparse estimation and the apriori information of optical radar physics. | • Experience with Matlab or Python<br>• Fundamentals of probability and statistics<br>• Multivariate analysis<br>• Linear algebra<br>• Optimization<br>• Signal and image processing | | | Y | | | Y | | |
| Edinburgh, South Australia | ISSD | Noise reduction in speech | Automatic speech processing can be improved by the intelligent application of speech enhancement techniques. This mainly IT project will both implement and use existing audio enhancement techniques to improve speech quality prior to automatic speech recognition. The project will use of machine learning techniques to train models that enhance the speech in audio. | • Software development<br>• Machine learning | | | Y | Y | | | | |
| Edinburgh, South Australia | ISSD | Deep Learning for Multilingual Named Entity Extraction | Named entity recognition system identifies and classifies references mentioned in unstructured text into pre-defined categories or entity types such as person names, organisations and locations.<br>This project aims to explore various state-of-the-art Machine Learning/AI systems for Human Language processing. | • Python coding experience | | | Y | Y | | Y | | |
| Edinburgh, South Australia | ISSD | Multilingual and multimodal language modelling and retrieval | This project will focus on machine learning and information retrieval techniques to triage and understand multilingual and multimodal datasets. The successful student will work within a team to extend functionalities within an existing framework, integrating new methods to train natural language processing models and evaluate against existing benchmarks. An interest in machine learning, natural language processing and information retrieval are strongly preferred, and skills in language/s other than English are desirable but not essential. | • Software development<br>• Machine learning | | | Y | | | | | |
| Edinburgh, South Australia | JOAD | Innovation in Land Warfare | Through analysis of historical and contemporary warfare, the project seeks examples of how Land Forces have changed the way they operate (through evolution, adaptation and innovation) in response to changes in the operating environment, particularly emerging technology. Areas of interest include warfighting concepts, strategy/tactics, doctrine/training and weapons/technology. In addition, we are interested in the effectiveness of new ways of operating in battle- is there evidence of causality between change and improved operational outcomes? The project outcomes will be used to inform how similar changes could occur in the future, in response to changes in the future operating environment. | Candidates are likely to come from the Social Sciences, particularly International Relations (military aspects of security studies) and History<br>• Required skills include literature review, analysis of historical data, ability to analyse and synthesise qualitative data<br>• Interest and knowledge of warfare (historical, contemporary and future) would be beneficial | | | | | | | | Y |

| Location | Division | Project Title | Project description | Desirable Skills | Research Streams | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AAENA | CRBFS | CSITSET | EEE | MS | MP | MMER | PSS |
| Edinburgh, South Australia | JOAD | Future Technology Concept Exploration (FTCE) Evaluation Framework | 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. 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. | • Mathematics and coding ability | | | | Y | | Y | | |
| Edinburgh, South Australia | JOAD | Terrain processing for simulation | Several combat simulation tools are used in the Land Capability Analysis (LCA) branch for Operations Research. These simulation tools each have unique requirements with regards to the format of their simulated terrain environments. While LCA have a working set of processes for generating these environments, it is desirable to investigate alternative options with regards to software and tools. The objective of this project is to produce a working, proof-of-concept, automated processes to generate virtual environments for a variety of specified formats, from a combination of government and open source terrain data. The student will be provided access to all the required software and data, and technical guidance on the end formats and source formats. This project is an exploratory and learning process; prior familiarity with virtual terrain software and data is not a requirement, although it is desirable. | Required skills include: <br>• General software development skills and familiarity with scripting languages <br>Highly desirable skills include: <br>• Familiarity with Geospatial Information Systems (GIS) <br>• Aptitude for coding, particularly in Python <br>• Desirable skills include: <br>• Familiarity with Simulation <br>• Aptitude for GIS software, particularly QGIS and / or ArcGIS | | | Y | | | Y | Y | |
| Edinburgh, South Australia | JOAD | AI Enabled Wargaming | In order to support the force design process, the Land Capabilities Analysis (LCA) MSTC at DSTG delivers S&T that uses constructive and wargaming 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. This approach, while pragmatically sound, has weak points, which include: <br>• Subject matter expert's input into the entities behaviours will always be biased based on past operational experience and current force capabilities. Therefore, novelty in blue force behaviours using future force components may be limited <br>• Novelty in red team behaviours may be hard to generate and hence blue force weaknesses in strategy and tactics may not be discovered <br>• The range of possible outcomes that can be obtained is limited due to the costs involved in programming time for each variation in entities' behaviour. <br>Machine-discovered behaviours may alleviate the aforementioned weaknesses by potentially uncovering novel tactics or strategies using simulated entities that analysts and subject matter experts may not have anticipated during the design of experimentation phase. This project seeks to construct machine learned AI agents in a custom built wargame that can demonstrate enhanced decision making within a red teaming context. | • Modelling skills, software development <br>• Excellent computer, verbal and written communications skills <br>• General software development skills, scripting, source control configuration management | | | Y | | | Y | Y | |
| Edinburgh, South Australia | JOAD | Vegetation Modelling | Take an existing "box" model of vegetation in a computer wargame simulation and first develop an improved canopy layer within that model and then exploring options to develop a more realistic vegetation model. | Critical Skills: <br>• Software development, python scripting skills, good communication skills, ability to work in small (5-person) teams, motivated and goal focused <br>Nice to have: <br>• Experience with geographical information systems <br>• Simulation modelling. | | | Y | | | Y | | |
| Edinburgh, South Australia | JOAD | Standard Testing Suite | Develop scenarios for a combat simulation, software to generate scenarios automatically, software to implement metrics of success for entities competing in these scenarios. | Critical Skills: <br>• Software development, python scripting skills, database skills, good communication skills, ability to work in small (5-person) teams, motivated and goal focused <br>Nice to have: <br>• Experience with mathematical <br>• Simulation modelling. | | | Y | | | | | |
| Edinburgh, South Australia | JOAD | Generalised Terrain Generation Tool | Take an existing terrain generation tool and transition it into ArcGIS so that users can enter terrain on a web service making it easier to distribute. | • Software development skills with a focus on Java server implementation and Vue.js, geographical information systems, good communication skills, ability to work in small (5-person) teams, motivated and goal focused | | | Y | | | | | |
| Edinburgh, South Australia | JOAD | Battlebook | Take an existing service creating a Battlebook for simulations from a database and make it a standalone service. | • Software development skills with a focus on Java server implementation and Vue.js, good communication skills, ability to work in small (5-person) teams, motivated and goal focused. | | | Y | | | | | |

| Location | Division | Project Title | Project description | Desirable Skills | Research Streams | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AAENA | CRBFS | CSITSET | EEE | MS | MP | MMER | PSS |
| Edinburgh, South Australia | JOAD | Analytical Hierarchy Process | Implement software to deliver the Analytical Hierarchy Process Multi-Criteria Decision Method in an online wargame tool. | • Software development skills with a focus on Java server implementation and Vue.js, good communication skills, ability to work in small (5-person) teams, motivated and goal focused. | | | Y | | | | | |
| Edinburgh, South Australia | JOAD | Automating building Battle Rhythms | Battle Rhythms are a circular schedule of work used to generate Situation Awareness and Battle decisions in Headquarters. They are traditionally built handraulically & producing a tightly working one that is error free requires significant tacit knowledge of both military requirements and scheduling theory. We are developing a Battle Rhythm specification language to allow users to express what they need and allow the system to produce a Battle Rhythm that satisfies those needs. The objective is to produce one or more problem solvers / optimisers that can produce workable schedules accounting for staff availability and skills, tasks to be performed, resources and deadlines. This is not a matter of producing a roster, as choices will be made on the basis of roles and skills available on a per shift basis. | • A combination of mathematical and computer programming skills in optimisation, search algorithms and constraint programming<br>• Must have good skills in code documentation, coding and project write up<br>• Coding will be in one of java or python<br>• Desirable skills include:<br>　o Good knowledge of graph theory, various search approaches such as genetic search, simulated annealing and other optimisation approaches<br>　o Deterministic algorithmic approaches for scheduling, computational complexity and efficiency O(n), dynamic programming, constraint programming, knowledge of code libraries that go with the programming languages, HTML (for output), libraries to build spreadsheets (for output)<br>• We do not expect the student to have knowledge of all of these areas, but more is better<br>• This project could extend to GUI construction if the student is skilled in this are but this would only be attempted after the primary requirement is complete | | | Y | | | Y | Y | |
| Fishermans Bend, Victoria | JOAD | Visualization for Force Design | The ADF's force structure is constantly changing due to emerging threats, development of new technology and changes to Government policy. To keep track of these changes and to make further changes, the ADF has a deliberate and rigorous process to understand the operation, organisation and design of the force. As such, there is a lot of data collected relating to the ADF platforms, systems, capabilities and their performance that span multiple databases.<br>This project will contribute to web-based visualization of the ADF's force structure and aerospace capabilities to enable users to navigate and comprehend the data.<br>Project options include designing a set of icon and vignette visualizations, or creating novel animated transitions between different views to improve user interaction with and understanding of the data. | • General coding skills, with a preference for JavaScript<br>• Skills in one or more of the following:<br>• Human Computer Interaction, Design, Visualization or Computer Game Design<br>• Interest in User Experience<br>• Ability to work in teams | Y | | Y | | | Y | | Y |
| Fishermans Bend, Victoria | JOAD | Updating Knowledge Representation and Organisation with New Information | The ADF's force structure is constantly changing due to emerging threats, development of new technology and changes to Government policy. Our understanding of the performance of the evolving force structure is also changing as new experiments and studies are conducted and aircraft, bases, tactics and threat systems change over time. Sometimes the new information supersedes the old information, and sometimes the conclusions from previous studies remain valid and can be retained.<br>This project is about solving the problems of maintaining a body of knowledge that accumulates over a number of years so as to allow algorithmic re-evaluation and reorganisation of answers to old questions to provide answers to new questions. For example, we may like to understand the effect of upgrading a sensor on a platform and the implications of this upgrade for previous studies on the platform of interest. We want to understand how we can use data and algorithms to facilitate the re-use of knowledge while it is reliable and to know when and how it becomes outdated.<br>Project options will include exploring the literature for approaches to solve this problem, and may include writing code to automate this process. | • General coding skills, with a preference for JavaScript, Pytho, DJANGO, D3<br>• Skills in one or more of the following:<br>　o Human Computer Interaction, Visualization or Computer Game Design, Data visualisation<br>• Interest in coding<br>• Ability to work in teams | Y | | Y | | | Y | | Y |
| Fishermans Bend, Victoria | JOAD | Compassionate artificial intelligence: empathy training as a future work possibility | The authors of "Human + Machine: Reimagining Work in the Age of AI" (artificial intelligence) describe an empathy trainer as '…an individual who will teach AI systems to display compassion'. What could be involved in the work of an empathy trainer for the Royal Australian Air Force (RAAF)?<br>The aim of this project is to develop background knowledge that may eventually help the RAAF to imagine such a role.<br>The successful applicant will survey the published literature on artificial empathy, i.e. empathy and artificial agents. If there is a need or opportunity, they may extend the project to include | • Interest in pursuing further studies in research and designing experiments | Y | | Y | | | Y | | Y |

| | | | | | AAENA | CRBFS | CSITSET | EEE | MS | MP | MMER | PSS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | models or theories of empathy, a critique of the concept of empathy training for AI, or the topic of collaborative robots. | | | | | | | | | |
| Fishermans Bend, Victoria | JOAD | Bias in 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 model using traditional modelling methods. 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, peer reviewing responses and aggregating responses from experts. This 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 code to implement an aspect of this research. | • Interest in pursuing further studies in research and designing experiments<br>• Project may be extended to include coding for proposed experiment design<br>• If coding, prefer knowledge and experience in Python, DJANGO (but not essential) | Y | | Y | | | Y | | Y |
| Fishermans Bend, Victoria | JOAD | Simulation Development to Analyse Defence Operations | 1. Contribute to the development of a simulation framework for aerospace operations.  Includes sensor, weapon and platform computational models. Student to be given specific code examples at the beginning of the project<br>2. Contribute to artificial intelligent agent modelling with C++/Python.<br>3. Contribute to the development of data analysis simulation capability. | • General software development skills<br>• Familiarity with object orientated programming<br>• Interest in artificial intelligence<br>• Interest in game development/simulation<br>• Interest in high-performance cluster computing environments<br>• Motivated and goal-focussed<br>• Good verbal and written communication skills<br>• Ability to work in teams | Y | | Y | | Y | Y | | |
| Edinburgh, South Australia | LD | Real world and robotic simulation for vehicle autonomy | The Advanced Vehicle Systems group conducts research and development in autonomic control for land vehicles. Experiments and tests of this system are conducted using simulation environments and small-scale robotics demonstrators.<br>In this project, you will support the development of our testing platforms enabling experimentation in the area of unmanned systems control and counter swarm technologies. The three key focus areas are:<br>1. Extending a pre-existing 2D simulation environment based on the OpenAI Gym toolkit (https://gym.openai.com/)<br>2. Extending a pre-existing 3D simulation environment developed within Unreal Engine (https://www.unrealengine.com/en-US/)<br>3. Integrate sensors and implement algorithms on Clear path Jackal robots (https://clearpathrobotics.com/jackal-small-unmanned-ground-vehicle/) | • Software development skills<br>• Experience with Python and/or C++ is desirable<br>• Ability to work independently and as part of a team | | | Y | | | Y | | |
| Edinburgh, South Australia | LD | Distributed RF Signature Management | The Advanced Vehicle Systems (AVS) team is developing a distributed autonomic mission system manager (Ravos) for the coordinated management of mission systems across a federation of vehicles.  This includes the creation of a low probability of detection (LPD) communication application which will function as part of the Ravos system. The LPD application utilizes distributed context awareness and distributed control to minimize the RF signature of radio systems through the automatic adjustment of transmission power.<br>A student working on this project would contribute to the transition of LPD algorithms from hardware in the loop simulation to robot land platforms. | • Experimental skills, modelling skills, software development<br>• Excellent computer, verbal and written communications skills<br>• General software development skills, scripting, source control configuration management<br>• Python programming experience required<br>• Good communication skills<br>• Ability to work in teams<br>• Motivated and goal-focussed | | | Y | Y | | Y | | |
| Fishermans Bend, Victoria | LD | Pyrolysis of Chemical Warfare Agent simulants | The destruction of chemical warfare agents (CWAs) represents a significant challenge to fielded military forces operating in a contested or non-permissive environment. In this context, mobile destruction systems provide an opportunity to destroy CWAs in-situ and minimise the risks associated with transporting and storing large quantities.<br>The thermal destruction of chemicals is of interest to the Defence community as it represents a potential solution for the disposal of highly toxic chemicals. To understand the energy requirements of thermal destruction systems and to determine destruction and removal efficiencies, the activation energies ($E_a$) and rate constants ($k$) for the unimolecular decomposition of chemical species of interest are required.<br>The focus of this project will be the validation of a laboratory-based pyrolysis system and optimisation of the analysis methodology. Validation of the pyrolysis system will include furnace temperature profiling and optimisation of the sample introduction technique. The pyrolysis system relies on the capture of unpyrolysed analyte onto an adsorbent media to determine the destruction rate efficiency. A key objective of this project will be to develop, optimise and | • Analytical chemistry, including an understanding of gas-chromatography mass spectrometry<br>• Scientific report writing skills<br>• Ability to work in teams<br>• Motivated and goal-focussed<br>• Excellent verbal and written communications skills | | Y | | | | | | |

| Location | Division | Project Title | Project description | Desirable Skills | Research Streams | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AAENA | CRBFS | CSITSET | EEE | MS | MP | MMER | PSS |
| | | | validate the GC/MS thermal desorption methodology with a selection of CWA simulants and internal standards. | | | | | | | | | |
| Fishermans Bend, Victoria | LD | All Aussie Armour | Creation of a hard armour plate sourced from Australian materials and manufactured in Australia | • Experimental and analytical skills<br>• The ability to communicate with a wide variety of stakeholders, both verbally and in writing<br>• Mathematical and fast engineering modelling skills<br>• Ability to work in a team environment<br>• Motivated and goal oriented. | | | | | Y | Y | | |
| Fishermans Bend, Victoria | LD | Development of a new testing device for body armour development | The candidate will work in a team on a large project developing a new novel testing rig for ballistic impacts, and developing prototype body amour which will be tested with the rig. May also help with FEA models of body armour. | • Experimental skills and/or FEA an advantage | | | | | Y | Y | Y | |
| Fishermans Bend, Victoria | LD | Development of Prototype Cooling Vest | This project looks at designing and manufacturing a prototype cooling vest unpowered or powered.<br>Outcomes:<br>1. Design Modification:  Identify and rectify issues with design<br>2. Manufacture: Redesign (design Drawings CAD) and construct unpowered or powered options TRL 4<br>3. Evaluate Performance - Manikin Testing<br>Tasks:<br>1. Re-evaluate the current designs and modify to ensure working prototype and performance.<br>2. Determine suitable models to achieve a level of flexibility in line with physical movement and comfort whilst achieve the desired performance criteria. | • Experimental skills, engineering, manufacturing, testing<br>• Excellent computer, verbal and written communications skills are required to undertake this project<br>• Ability to work in teams<br>• Self-motivated and driven with strong  outcome focus<br>• Level of self-management. | Y | | | | Y | | Y | |
| Fishermans Bend, Victoria | LD | Biomarker Discovery in Human Biofluids following Chemical Warfare Agent exposure | 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.  To support this effort, DST has for a number of years had a program to develop a standardised protocol for the identification of metabolites that arise from the exposure of chemical warfare agents to plasma.  This is particularly important as the number of agents increases.  This project will involve the continuation of this work to apply the separation of proteins in plasma using a combination of 2D Gel Electrophoresis, High Performance Liquid Chromatography and mass spectrometry to both identify the changes in the protein profile and identify and characterise these changes.  These modifications will be used in current methodologies utilised for the identification of biomarkers and the development of new analytical strategies.  The first agents of interest following standardisation are the nitrogen mustards that will be vital for the successful completion of future Proficiency Tests. | • Good communication skills<br>• Ability to follow instructions and understand scientific literature<br>• Good wet chemistry experimental skill<br>• Knowledge of mass spectrometry<br>• Gel Electrophoresis<br>• Ability to work in a team | | Y | | | | | | |
| Fishermans Bend, Victoria | LD | Reactive skin creams for protection against chemical warfare agents | Since the First World War, chemical weapons have been used in warfare and acts of terrorism. Deadly chemical warfare agents (CWAs) can cause harm simply by coming into contact with the skin. For protection, soldiers must wear protective suits, but these suits can create a high level of burden and discomfort that impairs their ability to perform physical work. Topical skin protectants (TSPs) are an alternative form of protection. TSPs are a type of skin cream that when applied to the body, creates a protective coating that will block CWAs from penetrating through the skin. TSPs that can absorb and rapidly react with CWAs to neutralise their threat are currently in development, and may provide game changing protection for soldiers operating in a hazardous chemical environment. The Chemical and Biological Agent Protection Team at Defence Science and Technology Group is seeking an enthusiastic student to participate in the development of TSPs that will protect soldiers operating in a CWA contaminated environment. It is expected that the student will participate in the following tasks:<br>i) Synthesise and characterise several reactive adsorbent materials with promising properties<br>ii) Develop TSP formulations containing reactive adsorbent materials aiming to provide both protection and good user conform<br>iii) Test TSP formulations to show they provide protection against toxic chemicals<br>iv) Present findings in report, presentations and meetings | • Experimental skills<br>• Chemistry and chemical engineering skills desirable<br>• Excellent verbal and written communication skills<br>• Ability to work in teams, motivated and goal-focussed | | Y | | | | | Y | |
| Fishermans Bend, Victoria | LD | Individual Protective Equipment (IPE) Systems Testing Development and Optimisation | The Chemical and Biological (CB) Protection team tests individual protective equipment (IPE) such as CB suits and respirators on a full sized articulated manikin system within a controlled environment chamber. We undertake continual development of the test method and associated hardware so that we can provide high quality information and advice to end users. Currently, we are investigating different passive adsorbent polymer samplers for chemical vapours, and various ways that we can use DST-developed electronic real time samplers to provide additional information from the standard test. We also want to attach a breathing machine to the | • Ability to work autonomously and in teams<br>• Familiarity with chemical laboratory safety<br>• Wet chemistry skills<br>• Good written and verbal communication<br>• Some design skills would be highly regarded | | Y | | | | | Y | |

| Location | Division | Project Title | Project description | Desirable Skills | Research Streams | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PSS | | | AAENA | CRBFS | CSITSET | EEE | MS | MP | MMER | PSS |
| | | | articulated manikin to generate more realistic test data. This multifaceted project would involve the opportunity to work on several topics: - Comparison of new polymer adsorbents against established materials for passive chemical vapour detection, including materials characterisation and analytical work (GC-MS) - Investigating different ways to mount electronic real time sensors, including design and 3D printing prototypes for development of low profile mounting receptacles - Integration of a breathing machine with the articulated manikin, initially demonstrating functionality in the laboratory, and then completing full scale tests in the environment chamber against aerosol and vapour challenges. | | | | | | | | | |
| Fishermans Bend, Victoria | LD | Creating a realistic 3D physics based soldier model for camouflage effectiveness assessment | Signature Management and Simulation team within Land Division is tasked to develop a suite of integrated signature modelling and simulation capability that will meet the challenges for developing the future enabling soldier. The ability to model a real-world camouflage object/target in a range of simulated environments is crucial for future camouflage design, development and assessment in the contemporary military operating environment. You will join our dynamic, multi-disciplined Signature Management and Simulation team, learn and experience working with a suite of state of arts 3D simulation and modelling tools, techniques and systems including realistic ray-tracing model, physic based modelling tool for Hyperspectral and Infra-Red EMS. Software and simulation environments include (but not limited to) Virtual Battle Space, MuSES, Maxwell Renders, and a range of 3D model creation tools (e.g. CAD, blender, Frog etc.). You will also have access to cutting edge data collected by spectroradiometers, infrared sensors, hyperspectral imagery and UAV imagery. You will be part of the team, developing the methodology and the soldier models that feed in our suite of simulation tools/environment (from game engines, to realistic ray-tracing models, physics based modelling tool), and assessing the model fidelity as part of the trial team. | • Modelling skills – 3D modelling<br>• General programming and scripting skills (matlab, python, etc.) for data processing and automation – strongly desirable<br>• Good communication skills<br>• Able to work in a team as well as working independently | | | Y | | | Y | Y | |
| Fishermans Bend, Victoria | LD | Smart materials for directional liquid transport | This project is to develop novel materials using DST's recent patented technology to prevent the permeation of liquid across fabric. A student will work with our university research and industrial partners to design, fabricate and test new devices. | • Experimental skills<br>• Manufacturing testing<br>• Excellent computer, verbal and written communications skills<br>• Good communication skills<br>• Ability to work in teams<br>• Motivated and goal-focussed | | | | | Y | | | |
| Fishermans Bend, Victoria | LD | Navigation in UAV Swarms | The Advanced Vehicle Systems (AVS) group is advertising an IEP internship opportunity in the area of navigation in UAV swarms. The IEP projects will be supervised by internal and external experts and will contribute to collaboration projects with industry partners. Preferred candidates will require a strong background in either area of control systems, robotics, mathematics, computer science, physics or other related sciences. The project will involve programming and implementation of the swarm navigation algorithms using the Robot Operating System (ROS) and the Gazebo environment. Prior experience with these software frameworks is highly desirable but not necessary. Later stages of the project could provide the opportunity of implementing the simulation tested algorithms on a small fleet of UAVs. The duration of this internship opportunity is flexible, up to 12 months and no shorter than 6 months. | • Experience in multi vehicle coordination<br>• Software development<br>• Algorithm implementation in hardware | | | Y | | Y | | Y | |
| Fishermans Bend, Victoria | LD | Employment of In-service Applicators for Suppression of Radiological Aerosols during Decontamination | Continued operation of personnel within or transfer from the contaminated (hot) to a clean zone may require suppression of CBR materials deposited on the exposed surfaces of the IPE. In the context of this WP, suppression of CBR materials is defined as the ability to minimise or stop secondary contamination, i.e., the ability to prevent release or resuspension (re-aerosolisation) of deposited materials from the contaminated surfaces into the surrounding environment. The re-suspended airborne CB material may lead to a secondary exposure of personnel and environment contamination. The suppression effect can be achieved by encapsulation, coating or wetting of the contaminated surfaces by a suitable suppressant delivered in aerosol form. Spraying devices, commonly used for a range of industrial and agriculture applications (e.g., paint spraying, pesticides dispersion), have the potential for aerosolisation and delivery of the suppression materials onto the contaminated IPE surface. Currently, there is limited information available in that area and the proposed WP addresses some of the fundamental questions relevant to the use of spraying devices for CB materials suppression. The technology is of interest to the Defence as it may enhance its existing capability in the area of personnel CBR protection. | • Ability to work autonomously and in teams<br>• Familiarity with laboratory safety<br>• Physics<br>• Some exposure to aerosol science<br>• Good written and verbal communication<br>• Proactive and shows initiative<br>• Motivated and goal focused | | Y | | | Y | Y | | |
| Fishermans Bend, Victoria | LD | Improvised and Expedient Mixing Strategies for Dahlgren Decon Chemical and Biological Warfare Agent Decontaminant | Dahlgren Decontaminant is a commercially available, 3 part decontaminant being introduced into the ADF to neutralise Chemical Warfare Agents Toxic Industrial Chemicals and Biological Warfare Agents. Dahlgren Decon must be mixed prior to use. The purpose of this project is develop and evaluate | • Ability to work autonomously and in teams<br>• Familiarity with chemical laboratory safety<br>• Analytical chemistry<br>• Good written and verbal communication<br>• Proactive and shows initiative | | Y | | | Y | | | |

| Location | Division | Project Title | Project description | Desirable Skills | AAENA | CRBFS | CSITSET | EEE | MS | MP | MMER | PSS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | various strategies for improved mixing or expedient mixing of Dahlgren Decon that would be suitable for use under operational conditions by ADF personnel.<br>• Determination of pot life (how long is a mixture able to deliver a useful decontamination effect for after mixing)<br>• How much mixing action is necessary to achieve an appropriately mixed DD? How can it be expedited, if at all possible?<br>• What happens to decontamination efficacy if mixing is incomplete, or if the components are all mixed together?<br>• What happens to decontamination efficacy if components are mixed in the incorrect sequence?<br>• What happens if mixing is undertaken at high temperatures or low temperatures? Is mixing better or worse, is the pot life improved?<br>• Are there any risks to using closed containers, such as cocktail shakers, to mix DD (i.e. the container becoming pressurised due to gas evolution). Is this pressurisation effect dangerous or acceptable<br>The intent is not to use laboratory mixing apparatus such as stirring rods etc. but to utilise devices that could feasibly be expected to be used in an operational environment such as:<br>1. Beaker with stirring rod<br>2. Cocktail shaker<br>3. Portable battery operated smoothie maker<br>4. Concrete mixer<br>5. Also identify any devices that could incorporate storage of the DD components and then facilitate mixing when necessary (like a binary munition). | • Motivated and goal focused | | | | | | | | |
| Fishermans Bend, Victoria | LD | Chemical Analysis and Imaging of Chemical Warfare Agent Simulant Removal from surfaces | The ADF requires a better understanding of how Chemical Warfare Agent (CWA) contamination is removed from surfaces, however DST lack the facilities to safely conduct experiments in CWA removal from surfaces and the analytical chemistry required to execute these experiments is time consuming. Furthermore the results from the analytical chemistry do not provide any information about where and how agent is retained on complex surfaces.<br>This project proposes to utilise common CWA simulants such as methyl salicylate mixed with commonly used infection and contamination training tools such as GloGerm to produce a mixture that will mimic the surface retention adsorption of CWAs and be able to be imaged under UV light.<br>Furthermore this project proposes to utilise image analysis software to try and quantify or semi-quantify residual surface contamination by comparing residual surface contamination determined by image analysis software to residual surface contamination as determined by analytical chemistry.<br>The project is also intended to develop procedures for employing this technique in the decontamination of personnel to monitor for cross-contamination, a term used to describe the phenomena where contamination from one individual or surface is inadvertently transferred to another individual or surface. In this instance, a different mixture of CWA simulant and GlowGerm or equivalent will have to be used in order to be safe for use will personnel.<br>This project is likely to involve the use of small scale trials of personnel, and personnel equipment, decontamination. | • Ability to work autonomously and in teams<br>• Familiarity with chemical laboratory safety<br>• Chemistry<br>• Some exposure to image analysis software<br>• Good written and verbal communication<br>• Proactive and shows initiative<br>• Motivated and goal focused | | Y | | | Y | | | |
| Fishermans Bend, Victoria | LD | Human Robot Teaming | Work with the Soldier Autonomy team to enhance the ability of the user to interact with the robot. Technologies to be investigate include gesture control, voice control. | • Software development, machine learning, robotics and mechatronics<br>• An interest in hands on development of software to be implemented for use in the field as a prototype | | | Y | | | | Y | |
| Fishermans Bend, Victoria | LD | Robot sensing | Work with the Soldier Autonomy team to enhance the functionality of our in-house robot design, including improving the robot mobility and control, integration of sensors (including camera, LIDAR, manipulation arm). | • Software development, machine learning, robotics and mechatronics<br>• An interest in hands on development of software and hardware related to robots to be implemented for use in the field as a prototype | | | Y | | | | Y | |
| Fishermans Bend, Victoria | LD | Simulation and virtual environments | Work with the Soldier Autonomy team to enhance the ability of the user to interact with the robot through the use of simulation and modelling. The successful applicant will have a strong interest in the use of modelling to enhance the performance and integration of software and hardware of robotic solutions for Army. The work could include the use of Augmented and/or Virtual reality tools to support modelling solutions. | • Software development, machine learning, robotics and mechatronics, modelling and simulation tools<br>• A strong interest in building and enhancing virtual environments and other modelling tools | | | Y | | | | Y | |
| Australian Technology Park, Sydney | MD | Investigation of bubble acoustics | This project will involve designing, building and testing an underwater bubble/aerator device, the aim of which is to produce underwater sounds. This will be used to potentially mask or mimic the sounds of ships from underwater sensors. | • Skills in physics, acoustics, electronics, software would be an advantage | | | | Y | | Y | | |

| Location | Division | Project Title | Project description | Desirable Skills | Research Streams | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AAENA | CRBFS | CSITSET | EEE | MS | MP | MMER | PSS |
| Australian Technology Park, Sydney | MD | Mechatronics/software engineer | Extend and update a Python-based robotics mission management interface | • Software development skills; robotics experience would be an advantage | | | Y | | | | Y | |
| Australian Technology Park, Sydney | MD | Systems Integration Engineer | Integration of optical sensors and hardware for remote sensing using small Unmanned Aerial Vehicles (UAVs) | • Computer systems integration/software skills<br>• Optical sensors experience would be an advantage | | | Y | | Y | | Y | |
| Australian Technology Park, Sydney | MD | Electronics/Mechatronics engineer | Develop automated data acquisition software in LabVIEW for various equipment | • Electronics and signal processing skills<br>• Programming skills in LabVIEW would be an advantage | | | | | Y | | Y | |
| Fishermans Bend, Victoria | MD | Weld Performance Analysis | This project involves weld testing and material characterisation (parent, HAZ and bead) of different ship grade welds to determine performance parameters under high-strain blast loads. The scope of this project is to assist understanding of weld variables in platform design for vulnerability to weapon threats. | • Competence in experimental lab environment<br>• Experience with materials testing machines<br>• University level written and verbal communication skills<br>• Willingness to learn new skills, ability to work in teams, ability to problem solve, good attention to detail | | | | | | Y | Y | |
| Edinburgh, South Australia | WCSD | Determination of Directed Energy Weapon effectiveness for parameterised operational environments. | The project includes a mixture of experimentation, modelling and analysis. The directed energy (DE) systems of interest include high energy lasers and high powered radio frequency systems. Much information about the effects of Directed Energy Weapons (DEW) has been established through experiments. The project aims to develop a framework that considers a range of targets and scenarios that are of importance to Defence and the parameters that would influence the effectiveness of a DE solution within these scenarios. The work will consider the structure and how to populate the framework, as well as determine how best to optimise the effects experimentation which will feed the modelling and simulation efforts. The modelling and simulation is aimed at predicting the weapon-target interaction effects for operationally relevant threats, range and environment through the use of representative materials. The project can be tailored to a range of program durations and the skills/knowledge of the individual. | • An understanding of experimental design<br>• Good verbal and written communication skills to liaise effectively between the modelling and simulation teams and the Laser DEW effects team<br>• Is innovative in their thinking to consider a breadth of ways DE can be used as an effector | | | | Y | Y | Y | Y | |
| Fishermans Bend, Victoria | WCSD | Modelling and simulation of effects of high power radio-frequency on semi-conductors and electronic components using Synopsys Sentaurus | A high power radio-frequency/microwave (HPRF/HPM) is referred as a short burst of electromagnetic radiation with peak pulse powers output at levels in excess of 100 MW. Exposure of electronics to such environment will cause them possibly to be disrupted, disabled and damaged.<br>This project is to use commercial software (e.g., Synopsys Sentaurus) to conduct modelling and simulation (M&S) of HPRF effects on semi-conductor electronic components, which can ultimately be used to:<br>• Estimate the incident energy/power required for functional kill<br>• Evaluate the effectiveness of HPRF/HPM against target systems | • Study in electronics engineering and physics<br>• Understanding of electromagnetic theory, wave propagation, and electronic system susceptibility | | | | | Y | Y | Y | |
| Edinburgh, South Australia | WCSD | Enhancing Aerial Scene Understanding with Semantic Context for Ethical Weapon | This project supports the DST's project, Moral Weapons, which looks at intelligent ways of codifying reasoning and rules into a weapon's ethics engine for collateral damage minimisation. The performance of the "ethical engine" will be highly dependent on the information received from the missile sensor. This project will focus on developing state-of-the-art machine learning and artificial intelligence algorithms to better understand the key objects (cars, people, trains, etc.) in a targeting scenario from an airborne sensor. By semantically understanding the types of objects around a target, we expect to make better "ethical" targeting decision and so reduce collateral damage to non-combatants. Realistic scenarios will be developed using the Unreal Engine (UE4) gaming software to explore the algorithms. We are looking for a passionate student to assist our team in developing these scenarios in UE4, and then analysing and exploring the latest machine learning algorithms for ethical weapon targeting. | • Good communication skills<br>• Ability to work in a team environment under broad directions<br>• Fluency in at least one programming language (ideally Python)<br>• Good problem solving skills<br>• Ability to read and understand scientific papers | Y | | Y | | Y | Y | Y | |
| Edinburgh, South Australia | WCSD | Ethical governor integration for Moral Weapons | This project supports the DST's project, Moral Weapons, which looks at intelligent ways of codifying reasoning and rules into a weapon's "ethical engine" for collateral damage minimisation. This project will principally focus on the development and implementation of ethical rules onto an autonomous weapon, with some development of state-of-the-art machine learning (ML) algorithms to detect and track objects around a target. Together these algorithms should make better "ethical" targeting decisions and so reduce collateral damage to non-combatants. Realistic scenarios will be developed using the Unreal Engine (UE4) gaming software to explore the algorithms. We are looking for a passionate student to assist our team in developing these scenarios in UE4, developing and implementing ethical rules and ML algorithms for weapon targeting and maintaining the underlying software code. | • Good communication skills<br>• Ability to work in a team environment under broad directions<br>• Fluency in at least one programming language (ideally Python)<br>• Strong software development skills<br>• Good problem solving skills<br>• Ability to read and understand scientific papers | Y | | Y | | Y | Y | Y | |

| Location | Division | Project Title | Project description | Desirable Skills | AAENA | CRBFS | CSITSET | EEE | MS | MP | MMER | PSS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Edinburgh, South Australia | WCSD | Advanced multi-robot decision making | Multi-robot teams are becoming increasingly important within both Defence as well as essential industries such as manufacturing and logistics. Our group is actively developing algorithms to control how these robots perform mission-critical tasks such as reconnaissance, search-and-rescue, and anti-air defence. We are looking for a passionate student to assist our team in developing state-of-the-art algorithms to help bring about these advanced capabilities. The student should have a strong academic background and should be interested in developing technical skills in areas such as optimisation, game theory, and machine learning. We would like to highlight that, while this project is geared towards applications within Defence and robotics, the student will gain highly sought-after skills that can be applied across fields such as operations research and software development. | • Strong background in mathematics, experience in algorithm development and/or optimisation, fluency in at least one programming language (preferably Python)<br>• Good problem solving skills<br>• The ability to read and understand scientific publications | Y | | Y | Y | | Y | Y | |
| Edinburgh, South Australia | WCSD | High speed multirotor drone operations | Our group is acquiring high-speed multirotor drones with some novel control features for use in exploring specific Defence warfare scenarios.  These drones will be used in flight tests with other systems to evaluate the development of novel intercept guidance algorithms being developed here using machine learning and artificial intelligence concepts.  The flight performance of these drones needs to be characterised and confirmed with key system parameters identified.  This will involve the planning and conduct of flight tests and the detailed analysis of flight data logs and environmental data.  Any required guidance and control system software upgrades will be made in order to allow these high-speed drones to be used in intercept engagements against competing drones.  We are looking for a motivated student to assist the team with the flight demonstration and analysis components of this project. | • Experience in robotics<br>• Fluency in at least one programming language (e.g. Python, C) and mathematics package (e.g. Matlab)<br>• Good background in mathematics<br>• Good problem solving skills | Y | | Y | Y | | | Y | |
| Edinburgh, South Australia | WCSD | Aerial swarm robotics | The nature of warfare is changing. Rapid improvements in robotics, parallel processing and artificial intelligence means swarms of aerial robotic systems will become common on the future battlefield. This poses a problem; how do we control large numbers of robotic systems in a complex battlefield environment?<br>Our group conducts research and development in machine learning and artificial intelligence applied to the control of aerial robotic swarms. Our goal is to develop advanced algorithms and then implement them in real UAV hardware that we can then test in flight trials at Defence ranges. Our role is to develop and mature this technology to the point that defence industry can transition it to a capability advantage for the Australian Defence Force.<br>We are looking for a motivated student to join our team in developing and demonstrating state-of-the-art algorithms in swarm robotics. The student should have a strong academic background and should be interested in developing technical skills in areas such as robotics, artificial intelligence, genetic algorithms, neural networks and machine learning. The student will gain valuable skills and experience in software development, scientific research, conducting simulation experiments, international collaborations and participating in Defence trials. | • Strong background in mathematics<br>• Experience in robotics or artificial intelligence<br>• Fluency in at least one programming language (ideally Python)<br>• Good problem solving skills<br>• Good communication skills | Y | | Y | Y | | Y | Y | |
| Edinburgh, South Australia | WCSD | Impact of electromagnetic interference on the performance of an Uncrewed Aerial Vehicle (UAV). | UAVs are being widely used in many Defence applications, and are consequently exposed to various electromagnetic environments. However, knowledge of the effects of electromagnetic radiation, especially from high power microwave sources, on the operation of a UAV is limited. Such knowledge would be useful for developing strategies and techniques to minimise the effects of electromagnetic radiation on the performance of the guidance and control systems of a UAV during its mission, as well as technologies that might be used to defeat an airborne improvised threat. The objective of the project is to establish an understanding of the vulnerability of the guidance and control systems of autonomous vehicles due to high powered electromagnetic radiation. Participation in experiments, analysing experimental data and modelling of the effects of the induced high powered electromagnetic radiation on the unit under test may be required. | • Experimental design<br>• Modelling & simulation<br>• Work in teams | | Y | | Y | | Y | Y | |