**IEP AD 01**  
**FISHERMAN'S BEND**  
**Development of an integrated sensing system for in-service evaluation of new composite materials on Defence platforms.**  
The position is located within the Smart Structures and Advanced Diagnostics group in the Air Vehicles Division, at Fishermans Bend, Melbourne. The group is involved in a range of activities focused on diagnostic health monitoring technologies for military aircraft structures and other high value Defence platforms. The successful applicant will be expected to contribute to a significant initiative on a high level international collaborative project evaluating the performance of new materials for Defence Platforms.

The position is applied in nature and will involve the incorporation of several established technologies and processes towards the development of an integrated fibre optic sensing system which may be operated remotely in the service environment. Primary design considerations for the system hardware will be optimisation of the size, weight, power budget and performance in harsh environments along with the development of software for automation, data storage and control. A major goal of the project is to apply this system to a planned service trial on a Defence platform in the near future.

- The student will work as part of a multidisciplinary team and be required to actively contribute to the design, assembly and test of the system. Knowledge of fibre optics is not a pre-requisite for this project as the tasks will focus mainly on system integration and software development and all the relevant background training in fibre optics will be provided. The experimental studies will validation of the system by taking measurements in a simulated service environment and then analysing the data where necessary and reporting on the findings. It is expected that the student will have exposure to LabVIEW, MATLAB and Solidworks during the course of their placement and will have the opportunity to develop their oral and written communication skills.

**Tasks/Duties Required**
- Under the direction of DSTO staff the student will (i) design and conduct experiments to evaluate the performance of microbolometer infrared focal plane array detectors for in situ diagnostic monitoring of structural coupons and full-scale combat aircraft structures; (ii) apply advanced signal processing techniques to extract information from experimental measurements; (iii) apply finite element modelling techniques to understand and decouple heat diffusion effects from thermoelastic response measurements.

**Relevant Research Area (academic disciplines)**
- Mechatronics, Computer science, Software engineering, electronics engineering, instrumentation and control, physics and fibre optics.

**Other Desirable Skills**
- Software development, Electronics hardware experience.

**General Information (personal requirements/academic qualifications)**
- Self-motivated, ability to work well in a team environment, ability to learn new technical skills quickly and apply them. Excellent academic results throughout undergraduate degree.

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**IEP AD 02**  
**FISHERMAN'S BEND**  
**Remote Infrared Diagnostic Imaging of Airframe Structural Health**  
The position is located within the Smart Structures and Advanced Diagnostics group in the Air Vehicles Division, at Fishermans Bend, Melbourne. The group is involved in a range of activities focused on diagnostic health monitoring technologies for military aircraft structures and other high value defence platforms. The successful applicant will contribute to the advancement of a novel thermoelastic stress analysis capability that exploits recent innovations in infrared microbolometer focal plane arrays. A major goal of the program is to adapt this infrared imaging technology to in situ structural health monitoring of military airframes. The student will be required to contribute to the design, construction and conduct of experiments to test, validate and demonstrate various aspects of this new diagnostic capability. The student will be exposed to important concepts in experimental mechanics, metallic fatigue, airframe lifting, infrared radiometry, heat diffusion, and signal processing, and will apply various software tools including a multi-physics simulation package (COMSOL), MATLAB and others. Involvement in this project will provide the student with insight into how fundamental research contributes to Australia’s defence capability.

- Under the direction of DSTO staff the student will (i) develop mechanical engineering, electronics engineering, materials engineering, physics, mathematics and software development.

**Tasks/Duties Required**
- Under the direction of DSTO staff the student will (i) design and conduct experiments to evaluate the performance of microbolometer infrared focal plane array detectors for in situ diagnostic monitoring of structural coupons and full-scale combat aircraft structures; (ii) apply advanced signal processing techniques to extract information from experimental measurements; (iii) apply finite element modelling techniques to understand and decouple heat diffusion effects from thermoelastic response measurements.

**Relevant Research Area (academic disciplines)**
- Mechatronics, Computer science, Software engineering, electronics engineering, instrumentation and control, physics and fibre optics.

**Other Desirable Skills**
- Software development, Electronics hardware experience.

**General Information (personal requirements/academic qualifications)**
- Excellent academic results throughout undergraduate degree.

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**IEP AD 03**  
**FISHERMAN'S BEND**  
**Development, manufacture and evaluation of parasitic Energy Harvesting systems for vibrating airframes.**  
The position is located within the Smart Structures and Advanced Diagnostics group in the Air Vehicles Division, at Fishermans Bend, Melbourne. The successful applicant will be expected to be a significant contributor on a range of activities and projects in the DSTO Acoustic Electric Feedthrough and Feedthrough Systems group. 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 airframe accelerations, with the goal of powering structural health monitoring devices. The second aspect of the project is to further development of the DSTO Acoustic Electric Feedthrough, which is an adaptation of work carried out at NASA. The Acoustic Electric Feedthrough uses ultrasonic soundwaves to pass energy through the aluminium skin of an aircraft, allowing electrical power and communications to be delivered to diagnostic systems located inside an aircraft.

- The job itself will involve assisting DSTO personnel in the development, manufacture and evaluation of: (a) vibration energy harvesting devices, and (b) an Acoustic Electric Feedthrough system. The applicant will be required to carry out a variety of different tasks. Tasks include mechanical and electronic design, software 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. Matlab scripting may be used for COMSOLTM finite element Multiphysics modelling. MatlabTM may also be used for automation of various laboratory tests. SolidworksTM may be used for the development of mechanical design ideas. The applicant may be exposed to C++, required for low power embedded microcontroller, and high power Digital Signal Processing. Other scripting approaches may be implemented for LabviewTM electronic simulations (PetriNT, VBATM).

**Tasks/Duties Required**
- Under the direction of DSTO staff, develop mechanical and electronic designs, including software for: (a) acceleration based energy harvesting devices to provide power to aerospace structural health monitoring devices; and (b) the DSTO Acoustic Electric Feedthrough, utilising ultrasound to direct energy and two-way data communications through the skin of an aircraft.
- (i) As required, assist in manufacture of the components developed in part (ii).
- (iv) Laboratory based experimental validation.
- (v) Recording and analysis of data from experiments and reporting on the findings.

**Relevant Research Area (academic disciplines)**
- Mechanical engineering, electronics engineering, materials engineering, physics, mathematics and software development.

**Other Desirable Skills**
- Excellent academic results throughout undergraduate degree.

**General Information (personal requirements/academic qualifications)**
- Excellent academic results throughout undergraduate degree.
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- Excellent academic results throughout undergraduate degree.
**IEP AD 04**  
**FISHERMAN'S BEND**  
**Project Title:** Development of an Interactive 3D Visualisation Tool.  
**Project Description:** The Aircraft Structures Branch within the Aerospace Division of DSTO is developing a general purpose 3D visualisation tool. The purpose of this tool is to provide DSTO engineers with a simple, easy to use means of displaying 3D aircraft models (e.g. generated from existing CAD or Finite Element models) and overlaying customisable, location dependent data (e.g. instrument / measurement locations, damage / repair locations etc). Having defined the requirements of the tool and completed an initial design phase, ASB is due to commence implementation of the tool. Under direction of ASB staff, the successful candidate would lead the phased implementation effort and gain considerable experience in areas including: software engineering, data visualisation, 3D graphics, and aircraft structural integrity.  
**Tasks/Duties Required:** Under direction of DSTO staff and existing design documentation, conduct implementation of a general purpose 3D aircraft visualisation tool. Specific duties will include implementation / testing and future design / improvements of:  
- GUI  
- Data drivers  
- 3D viewers  
Adaptively, the successful candidate must be capable of communicating effectively with members of the project team, including key stakeholders, through regular meetings, documentation and reporting.  
**Relevant Research Area (academic disciplines):** Software Engineering, Computer Science.  
**Programming Experience:**  
- Programming Experience: C++, Qt, Python  
- Experience with 3D graphics  
- Effective written / oral communication skills.  
**Other Desirable Skills:**  
- A minimum of three years of study in a relevant discipline; aptitude for teamwork as well as ability to work independently; desire to work in a research environment  
**General Information:** Bachelor's degree (or the equivalent) in a relevant discipline; aptitude for teamwork as well as ability to work independently; desire to work in a research environment.

**IEP AD 05**  
**FISHERMAN'S BEND**  
**Project Title:** Development of a General Purpose Spectrum Processing Tool.  
**Project Description:** Aerospace Division (AD) within Defence Science Technology Organisation (DSTO) at Fishermans Bend is currently developing a general purpose spectrum processing tool for Aircraft Structures Branch. By applying a rigorous software engineering approach, our aim is to develop a high quality, validating tool that will serve the Division for years to come. This project represents the implementation stage of the development process. Its aims are to use existing Software Requirements Specification (SRS) and Software Design Description (SDD) to begin coding up elements of the tool in an object oriented language. This project will provide the successful candidate with a large amount of experience, including: (a) Software engineering within a research organisation; (b) Managing extremely large datasets; (c) High performance computing; (d) Aircraft structures and loading.  
**Tasks/Duties Required:** Under guidance from DSTO staff, use the SDD and SRS to begin implementation of the General Purpose Spectrum Processing Tool. (a) Implementation; (b) Testing; (c) Documentation; (d) Reporting.  
**Relevant Research Area (academic disciplines):** Software Engineering, Computer Science.  
**Programming Experience:**  
- Programming Experience: Java / C++  
- Experience managing large datasets, high performance computing  
- Effective written / oral communication skills.  
**Other Desirable Skills:**  
- A minimum of three years of study in a relevant discipline; aptitude for teamwork as well as ability to work independently; desire to work in a research environment.

**IEP AD 06**  
**FISHERMAN'S BEND**  
**Project Title:** Aerodynamic characterisation of a tandem-wing flapper.  
**Project Description:** Under its strategic Research Initiative on Unmanned Aircraft Systems, DSTO is researching flapping flight as a means of propelling and controlling small air vehicles. In this project, an experimental study will be conducted by the student to quantify the aerodynamics of a flapping-wing mechanism with tandem wing pairs. Previous work indicates that interactions between tandem wing pairs can be controlled by varying the phasing of their flapping cycles and that flight control of an air vehicle with tandem wings may be achievable through such interactions. Testing (and possibly further development) of algorithms to control tandem wing pairs will be undertaken by the student, along with laboratory measurement of the forces produced by each wing pair. Electro-mechanical design may also be required if modifications to the experimental equipment are necessary. Another student is currently working on this project throughout this year (2014) and it is expected that the work completed during this time will be passed onto the next student to continue in 2015. A detailed report will be written by the student to describe the experimental techniques and results, and an article describing the project will be submitted to a high-quality journal. The student will work directly with DSTO staff to carry out the laboratory components of this project and will work independently to carry out its non-laboratory components.  
**Tasks/Duties Required:** C++ programming; control system development and testing; laboratory testing with force/moment sensors; mechanical and electrical design; report writing; aerodynamic analysis; data analysis.  
**Relevant Research Area (academic disciplines):** Mechatronics, mechanical, electrical, aeronautical, or aerospace engineering; physics.  
**Programming Experience:**  
- C++ programming, MATLAB  
- Programming and analysis, desktop applications (Word, Excel, PowerPoint, Endnote).  
**Other Desirable Skills:**  
- A Bachelor's degree (or the equivalent) in a relevant discipline; aptitude for teamwork as well as ability to work independently; desire to work in a research environment.

**IEP AD 09**  
**FISHERMAN'S BEND**  
**Project Title:** Construction and testing of resonant mechanical oscillators for bio-inspired air-vehicle applications.  
**Project Description:** Under its strategic Research Initiative on Unmanned Aircraft Systems, DSTO is researching flapping flight as a means of propelling and controlling small air vehicles. Most mechanisms designed for flapping flight require power inputs to overcome inertial and aerodynamic forces that are significantly higher than those of comparably sized natural flyers. Many biological species (e.g. bees, flies, and hummingbirds) rely on elastic and/or resonant systems that recover energy during each wing stroke, vastly reducing the power required to sustain flight and commensurately increasing their hovering durations. Comparably sized mechanical systems exhibit maximum hovering durations of only 10-20 mins. The goal of the student project is the design, construction, and testing of one or more resonant mechanical oscillators that may serve as the basis for a flapping wing air-vehicle prototype. The work will start with a literature review of flapping mechanisms utilised in nature and insects, as well as the small number of mechanical systems incorporating energy recovery. The student will evaluate the mechanisms for use in a flapping-wing air-vehicle; and one or more designs would be selected (or devised) for construction. Laboratory measurements of the forces produced by the flapping mechanism (with an appropriately scaled pair of wings) and of the power required to drive the mechanism would then be performed by the student to characterise the mechanical designs. Another student is currently working on this project throughout this year (2014) and it is expected that the work completed during this time will be passed onto the next student to continue in 2015.  
**Tasks/Duties Required:** Laboratory experimentation; testing with force/moment sensors; experimental planning through dynamic analysis; aerodynamic analysis; data analysis; report writing.  
**Relevant Research Area (academic disciplines):** Mechatronics, mechanical, electrical, aeronautical, or aerospace engineering.  
**Programming Experience:**  
- MATLAB programming and analysis, desktop applications (Word, Excel, PowerPoint, Endnote).  
**Other Desirable Skills:**  
- A minimum of three years of study in a relevant discipline; aptitude for teamwork as well as ability to work independently; desire to work in a research environment.

**General Information**
- **Aeronautical, Electrical, Aerospace Engineering:**
  - **Programming Experience:**
    - C++, Java, Python
  - **Other Desired Skills:**
    - Experience with 3D graphics
    - Experience managing large datasets, high performance computing
  - **Other Desirable Skills:**
    - Effective written / oral communication skills
    - Experience in a research environment
    - Desire to work in a research environment

- **Other Relevant Research Areas:**
  - **Programming Experience:**
    - C++, Java, Python
  - **Other Desired Skills:**
    - Experience with 3D graphics
    - Experience managing large datasets, high performance computing
  - **Other Desirable Skills:**
    - Effective written / oral communication skills
    - Experience in a research environment
    - Desire to work in a research environment

- **Other Relevant Research Areas:**
  - **Programming Experience:**
    - C++, Java, Python
  - **Other Desired Skills:**
    - Experience with 3D graphics
    - Experience managing large datasets, high performance computing
  - **Other Desirable Skills:**
    - Effective written / oral communication skills
    - Experience in a research environment
    - Desire to work in a research environment
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<tr>
<td>IEP CEWD 01</td>
<td>EDINBURGH</td>
<td>Autonomic Cyber Security for Mobile Devices</td>
<td>Cyber Assurance and Operations Branch is undertaking ongoing research and development in the area of autonomous cyber systems. Working as part of a team, the candidate would be involved in developing and adapting software for mobile devices that performs cyber security missions autonomously. In particular: dynamic, distributed, and location-aware security functions. This will involve utilising and extending tools for distributed computing, sensing and actuation, and machine intelligence, on mobile devices (e.g. Android).</td>
<td>The candidate would be required to perform the following tasks: - Limited research into related topics in cyber security and related tools. - Gain familiarity with our development environment, tools and technologies. - Gain familiarity with software development for mobile devices (e.g. Android). - Jointly develop mission concept with team members. - Team-based software development, testing and documentation in accord with project goals. - Planning and time management. - Preparation of a written report and oral presentation of research work and demonstrator.</td>
<td>The following research areas are relevant: - Autonomous systems - Cyber security - Information security - Distributed systems - Machine intelligence - Robotics (control)</td>
<td>The following skills are desirable: - General software development skills (e.g., C/C++, or Java desirable) - Good communication skills. - Ability to work in teams. - Motivated and goal-focussed.</td>
<td>Our team currently includes researchers, developers and contractors developing new concepts and tools for building autonomous cyber systems. We are seeking a student who is keen to work with our team members to take on the challenge of autonomous capabilities in the cyber domain.</td>
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<td>IEP CEWD 02</td>
<td>EDINBURGH</td>
<td>Security and Utility Risk Evaluation for Cyber-Based Anomalies.</td>
<td>The project involves taking data produced by cyber data analytics about network, host and user-based anomalies within a system and using this data as the basis for quantitative cyber security risk assessment and mitigation using the Security and Utility Risk Evaluation (SURE) framework. The risk assessment will result in autonomous configuration changes to mitigate the risk while balancing the security and utility of the system.</td>
<td>Under guidance, the IEP student will: - Participate in the development of scenarios for applying the SURE framework to the results of data analytics. - Identify appropriate quantitative metrics and risk calculation methodology. - Extend the existing framework code base to implement chosen methodology. - Develop concept demonstrator for selected scenarios. - Write a DSTO Technical Note documenting the above work.</td>
<td>Computer Science, Cyber security.</td>
<td>Software development and Java programming skills are essential. Some mathematical background covering probability will be well regarded. Knowledge and understanding of the principles of cyber security would be advantageous.</td>
<td>The project would be suitable for a keen and self-motivated student seeking a challenging work program. Other desirable skills would include good communication abilities, both verbal and the capability to develop clear and concise documentation to accompany the developed products.</td>
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<td>IEP LD 01</td>
<td>FISHERMAN'S BEND</td>
<td>Full Mannequin Aerosol Testing – Detection techniques and method development</td>
<td>DSTO-LD has an Environmental Test Facility in which it can test Chemical Biological Radiological Nuclear (CBRN) protective clothing ensembles to determine fit and integration by using either a vapour or aerosol systems test. The vapour system test method is currently being commissioned, whereupon DSTO-LD will commence a significant test program. In contrast, the aerosol system test is in the initial stages of development, particularly with respect to under-suit aerosol detection systems. The main goal of this project is to assist with the implementation of a fluorescence-based detection system or systems that can provide real-time and/or post-run data for the quantification of the protection offered by different suits against aerosol particles.</td>
<td>Duties include activities to support ongoing vapour systems testing, and the development of the aerosol systems test. This includes but is not limited to: - Calibration, verification and day to day operation of scientific instrumentation including Thermal Desorption-GC, MIRAN IR gas analyser, Fluorimeter, the DSTO aerosol swatch test rig and mannequin test operations within the DSTO Environmental Test Facility.</td>
<td>Chemistry, Chemical Physics or other science-based discipline</td>
<td>Ability to take direction and perform tasks independently. Ability to problem solve and be ‘hands-on’ with varied instrumentation and equipment. Relevant training will be provided.</td>
<td>The student will contribute to a team project which is focused on developing a fully operational test capability for use by Defence to assess protective clothing ensembles against aerosol particles.</td>
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<td>IEP LD 02</td>
<td>FISHERMAN'S BEND</td>
<td>Analysis of Volatile Organic Compounds (VOCs) in Air</td>
<td>Aim: To develop GC/MS methodology for the analysis of volatile organic compounds (VOC) in air and complete basic characterisation of several air sampler technologies. Air samplers are an invaluable tool for identifying and monitoring the presence of toxic chemicals in the atmosphere and they provide essential information for consequence management and site remediation after a chemical release. This project will initially focus on the development of methodology for GC/MS analysis of the adsorbent matrix used in VOC air samplers. This will include method optimisation and limits of detection determination. The subsequent focus will involve conducting sampling control experiments, using both passive and active samplers, in order to inform basic air sampler characterisation by determining limits of detection determination for each technology and basic competitive adsorption effects. The developed methodology and knowledge from control experimentation will be utilised to complete analysis of VOCs using air samplers.</td>
<td>GC/MS analysis - GC/MS method development - Conduct of control experiments - Sample preparation - Data analysis</td>
<td>Literature review - Report writing</td>
<td>Applied Science/Chemistry (Analytical Chemistry &amp; Organic Chemistry)</td>
<td>The student will be working within an experienced team of Defence chemists. A demonstrated ability to work under own initiative will be valued and a good communication skills, both written and oral, is required.</td>
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<td>IEP LD 03</td>
<td>EDINBURGH</td>
<td>Military Vehicle Electrical Power System Characterisation</td>
<td>Vehicle electronics and Architectures (VEA) is an important capability group within the Land Division (LD). The VEA group undertakes research in future military vehicle electrical and communications systems capabilities and technology integration options. Research outcomes are used to provide impartial advice to the Australian Defence Force. The student would be working within a dedicated team of scientists and engineers focusing on integration studies associated with future military vehicle electrical subsystems, including electrical power generation, energy storage, and power management and distribution systems. Analysis of the impact of technologies in these areas is a core component of the work, and modelling, simulation and laboratory experimentation is an important enabler of this capability. The student involvement will focus on the continuing development of this modelling and hardware-in-the-loop simulation capability. This includes the collection of data through laboratory experimentation and field trials for use in models and validation of modelling and simulation outputs.</td>
<td>a) Modelling and simulation of military vehicle electrical systems, behaviour and/or components, and some model-based design and hardware-in-the-loop simulation. b) Aid in further development of a Military Votronics Systems Integration Laboratory. c) Conduct experimentation and evaluation of military vehicle systems and hardware. d) Develop software tools to meet specific experimental activities, e.g. data capture or analysis. e) Occasional opportunities for participation in experimentation and trials activities, within both civilian and military environments.</td>
<td>Electronic Engineering, Mechatronics, Aeronautical Engineering, Systems Engineering, Power Electronics, Robotics, Hybrid Vehicles</td>
<td>Matlab/Simulink, Embedded systems programming, Hardware-in-the-loop simulation, Experience with electrical testing instrumentation, Microsoft Excel, Visual Basic</td>
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<td>IEP MD 01</td>
<td>FISHERMAN'S BEND</td>
<td>Development of modelling and analysis tools to enhance the simulation of vulnerability for naval ships.</td>
<td>The Royal Australian Navy uses a variety of tools to assess ship designs in order to improve their safety and performance across a range of operations, including the impact of external threats. This project requires a software developer/engineer to enhance existing scientific modelling, simulation and analysis tools for assessing the impact of a range of threats to naval ships. The project would enhance the current analysis method by improving the ship modelling process, especially when converting from detailed CAD based models. Enhanced visualisation and analysis tools are also required to provide improved analysis of simulation data and scientific results that are more accessible for providing advice to the Navy. The project will develop on current simulation tools and environments used to identify a range of important information for the improvement of future ship designs. The project will provide details on the existing scientific tools used to model and simulate naval ships and the threats they may face. This includes programs such as CATIA and Rhino3D as well as the Unity 3D engine. It is expected that the software enhancements made during this project will be modular and reuse open source components where relevant.</td>
<td>1. Development of modelling tools and tool plugins that increase the vulnerability modelling capability of the group. 2. Design and Implement a suite of tools to visualise and analyse the results of ship vulnerability experiments. 3. Provide user manual aimed at users from a navy background.</td>
<td>Software engineering, software programming and ICT</td>
<td>Experience with CAD packages is highly desirable, as well as experience in 3D visualisation and gaming. Ability to program in C based programming language or a detailed knowledge of scripting languages is also desirable.</td>
<td>Start and end dates for project are flexible.</td>
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<td>IEP NSRD 01</td>
<td>EDINBURGH</td>
<td>Social Influence in Social Media: the role of non-linguistic modes of representation.</td>
<td>This project aims to develop a conceptual framework for an analysis of Social Media as instances of social and ideological influence. Specifically, this project aims to explore the heuristic potential of the methodology of Multimodal Discourse Analysis in social-political studies of the recent phenomenon of Web-based political activism, and use of the Internet for ideological purposes. The study will focus on the use of visual and multimodal means of information representation. Intended outcomes are: methodological frameworks to guide the choice and development of methods and techniques for intelligence analysis.</td>
<td>Literature review; data collection; data analysis; team work; technical presentations; report writing.</td>
<td>Social media research, sociology; mass communication</td>
<td>Student studying in sociology, communication, anthropology, and cultural studies.</td>
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<td>IEP NSRD 02</td>
<td>EDINBURGH</td>
<td>Can Big Data play a part in the ISR domain</td>
<td>1. Terms like big data and big data analytics have been around for a while but what do they really mean? How well is Defence positioned to make use of such concepts and technologies to perform its duties? This project will involve the investigation and testing of some big data concepts, technologies and available products such as Apache Hadoop and Accumulo. The deliverable for this project is a working prototype that can be used to demonstrate the feasibility of big data and big data analytics in the Defence Intelligence, Surveillance and Reconnaissance (ISR) domain.</td>
<td>Software Development, Software Configuration, Documentation, Team work; Technical Presentations.</td>
<td>Software Engineering, Computer Science.</td>
<td>Java/Java EE, Scripting languages: JavaScript, php, python</td>
<td>Student studying in a computer science and/or software engineering related field. Student needs to be an Australian Citizen and be eligible for a Negative Vetting Level 1 (SECRET) level clearance.</td>
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<td>IEP NSID 03</td>
<td>EDINBURGH</td>
<td>DSTD Nanosatellite development</td>
<td>An IEP student will work in support of DSTD’s Cubesat development program. The student will work in the spacecraft development team. The major research and development projects that the student will contribute to are, Project Buccaneer and the Miniaturised-Exchange Charge Thruster (M-CXT) research and development program. In Project Buccaneer a great deal of the hardware has been selected, the ongoing challenge is the integration of this hardware and the implementation of flight software that must interface with our ground station to facilitate the research objectives of the primary payload. The hardware will be integrated incrementally and the software will be developed as needed. This project is ongoing and hence incremental goals and objectives will be set through the placement. In the M-CXT research and development program a prototype thruster has been developed but the electronics to support the system have are at a preliminary design only. The student will work to further refine this electronics design including control and telemetry systems. The final prototype shall be integrated into a Cubesat. This project will also include Astrodynamics analysis to validate the use cases, control algorithms and operational modes for the M-CXT on future missions; this will include formation flying considerations.</td>
<td>- Support system engineering studies of the complete spacecraft system. - Flight and prototype hardware design. - Flight software development. - Test and evaluation of prototype systems, in clean room and vacuum conditions. - Architecture and functional integration of Flight hardware. - Modelling and simulation of spacecraft including thrusters.</td>
<td>Mechatronic engineering, Aerospace engineering, Electronic engineering, Systems Engineering</td>
<td>- Matlab experience - Embedded systems design - Digital hardware design - Analogue power design - Embedded software</td>
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<td>IEP NSID 04</td>
<td>EDINBURGH</td>
<td>High Performance Computing Cluster: Optimisation and Performance</td>
<td>The National Security Systems Analysis Task - Defence Science and Technology Organisation is in the process of advancing a cluster computing environment to undertake intensive image processing work. Due to requirement constraints, a Windows HPC cluster environment has been established. The cluster also provides a platform to run COTS software, various facial recognition algorithms and other tasks programs. An enduring project exists on optimisation of this cluster to enable better utilisation of this high performance Windows computing environment. The project focuses on software and its implementation into the cluster. The cluster provides an excellent opportunity to extend a student’s knowledge in this area and with the convergence of technologies such as multi-threading, GPU processing, multi-core utilisation and high speed networking, build skills and expertise in a domain that has great demand. It is not expected that the student has a great amount of knowledge directly in this domain, just that they are willing to learn. There are a number of areas that a potential student would be required to examine. These include, but are not limited to: • Cluster benchmarking and performance optimisation: Extension of the current performance of the cluster via improvements to networking and processor utilisation via the creation of relevant code and tweaks. Benchmarking would occur to note the performance over time. • Greater utilisation of GPU – To enable and use the node GPU processors to their full extent, primarily at the student's discretion, with the aim of maximising process capability. • Extension of MS Excel HPC – To streamline the intensive work of MS Excel, potentially with the coding of User Defined Functions. • The writing of scripts/code to facilitate the automation of common tasks at the cluster level (i.e. utilising HPC to conduct repetitive tasks such as: batch processing in Photoshop, batch zip processing, file manipulation, etc.).</td>
<td>- Contribute to the optimisation of the HPC Cluster - Develop software as required to Support task Research - Modelling and simulation of spacecraft including thrusters. - Modelling and simulation of spacecraft including thrusters.</td>
<td>Software Engineering, Computer Science, Information Technology, Biometrics</td>
<td>Experience with databases (SQL or other) Programming experience (C++, Java)</td>
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<td>IEP NSID 05</td>
<td>EDINBURGH</td>
<td>High-Level Information Fusion</td>
<td>We live in an age of information overload. Our research seeks to address this by building a system with the ability to automatically process large volumes of information from a variety of sources such that it is amenable to sophisticated question and answering is one of the great challenges of our age. Such a system would augment its user’s natural cognitive capabilities and minimise the burden of information deluge. We seek a high-achieving student with keen interest in artificial intelligence and natural language processing to work closely with our multi-disciplinary team on a state-of-the-art R&amp;D prototype system. Our agent-based, high-level information fusion system has a multi-modal controlled natural language interface with a virtual adviser and 3D virtual geo-spatial display. The system’s architecture is theoretically grounded in cognitive psychology and philosophy. The system is currently demonstrated in the context of a synthetic, but realistic scenario involving busy air and maritime environments. After processing natural language text documents and track data, the virtual adviser can be queried regarding information in the sources, and is able to provide situation reports about nominated platforms (radars, aircraft and ships) present in the data. The virtual one task may be to develop new situation reports. For example we would like to provide situation reports about submarines present in our track data. In our system, reports are constructed by identifying the path taken by a particular platform through a state transition system relevant to that platform. If one wants to report that a submarine submerges at a particular time, then one needs to provide a definition for a 'submerge state', so that the system can infer from the track data when a submarine is in such a state. Such definitions are written in a formal, logic-based language. We will assist you in understanding and further developing this language. We are also interested in providing automated alerts of anomalous behaviour. As track data is processed, we might want to trigger an alert whenever a commercial</td>
<td>- Knowledge-Representation, Automated Reasoning, Artificial Intelligence, Agent-Based Software, Information Fusion - Familiarisation with logic-based languages.</td>
<td>Potential to extend a further 6 months depending on performance and funding.</td>
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<td>adviser coordinates its responses with the virtual geo-spatial display.</td>
<td>aircraft deviates from an air-lane. This would require you to formulate a definition of a 'not on an air-lane state'. If the system can infer from the track data that a commercial aircraft is in such a state, then an announcement could be made by the virtual adviser and the event depicted on the virtual geo-spatial display. A task may be to develop such an alert.</td>
<td>The delivery of both situation reports and alerts involves story-telling with spoken dialogue and visually presented material. A number of factors need to be considered when constructing them. For instance, how specific does the information need to be? What emotional state should the virtual adviser be in? What appearance should the adviser take? How do we make use of camera angles and special effects as we replay or watch current events unfolding on the virtual geo-spatial display?</td>
<td>Another task may be to formulate a new, scenario-relevant text document which can be questioned and answered for demonstration purposes. In our system, surface-level natural language text is converted to deep-level assertions written in a formal, logic-based language. Natural language queries are also converted to this formal language. At this deep-level a reasoning system infers answers to queries. Answers are then converted into surface-level natural language text. To generate a natural language response to a natural language query regarding information in the text document, it is likely that you will need to provide formal, logic-based definitions for a number of natural language words and incorporate these within the system’s surface-deep-surface conversion mechanism.</td>
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<td>IEP NSID 06</td>
<td>EDINBURGH</td>
<td>Performance Evaluation of Automatic Speech-to-text Transcribers</td>
<td>This proposal consists of two sections that are related since they both attempt to compare and contrast performance achieved in transcribing speech by an automatic speech recogniser versus human transcriptionists.</td>
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<td>Section One: Error Correction of Transcripts Generated by an Automatic Speech Recogniser versus Human Operators</td>
<td>The aim is to investigate the performance, in terms of speed and accuracy, of correcting errors in transcripts produced by Dragon NaturallySpeaking Speech recogniser versus the performance achieved by participants manually transcribing audio and correcting errors using keyboard and mouse.</td>
<td>Familiarisation with principles and techniques in automatic speech recognition and speech-to-text transcription. Specifically, learning about Dragon NaturallySpeaking and how to create user profiles. Computer Science and Computer Engineering duties to get software systems up and running, as outlined in the project plan. Preparing and carrying out speech and audio experiments, namely experiments to evaluate the performance of Dragon NaturallySpeaking for transcription tasks. This includes: (i) recruiting subjects, and (ii) analysing performance results in terms of speed and accuracy, which can then be compared to performance with a human operator. Report on the findings and presenting the work done.</td>
<td>The Candidate should be studying Computer Science or Computer System Engineering. A candidate studying a combined Degree in Computer Science and Psychology, who also knows experimental design and statistical analysis, will be ideal.</td>
<td>An interest in speech technology and audio processing is desirable.</td>
<td>This is an area of research in which we are using novel techniques. It has potential to lead to external publications.</td>
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<td>Introduction</td>
<td>As early as 1982, an extensive list of over 80 factors that influence performance of speech recognisers were identified. Hence speaker’s gender, age, dialect, articulation and enunciation, and well as speaking rate, volume and disfluencies (such as ums, urs, false starts, repetitions) are amongst many variables to consider. As many variables as possible need to be kept constant whilst varying others.</td>
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<td>Dragon NaturallySpeaking speech recogniser is a speaker-dependent speech recogniser. It requires training (enrolment) by each speaker to create a customised acoustic model for that speaker that is known as profile. As well as life dictation, Dragon allows transcribing against a profile from recorded audio files individually or inside a directory.</td>
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<td>NIST Scito scoring package is used to compare a transcribed text to the reference text and score the percentage recognition accuracy. The package also gives types and numbers of errors in the transcript. DSTO has developed a technique to create a database of profiles so they can be automatically selected one by one for transcription and scoring.</td>
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<td>Procedures</td>
<td>Dragon NaturallySpeaking speech recogniser version 12.5 will be used. A considerable number of subjects (greater than 10) need to be considered for investigation of inter- and intra-speaker variabilities. All participants will be trained on the same script provided by Dragon NaturallySpeaking. The training process for each participant should only take about 30 minutes. Audio files or scripts for testing may be tailored to a particular domain (e.g. Army, Navy, Air Force or National Security). In any case specialised acronyms and abbreviations will have to be added to user vocabulary so as to be recognised by Dragon. These will be common to all participants. Typed scripts for the experiment are produced by the participant listening to the audio and transcribing the text. A foot pedal facility is available.</td>
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<td>NIST Scito will be used for performance scoring of hypothesis text (speech recogniser produced) versus reference text (original text). Of course, the reference text is from a correctly transcribed audio file. Although speech recogniser errors can be corrected via voice, this is not generally recommended by experts in the field. All errors in recognised text should be corrected by keyboard and mouse. Basic typing speed of each participant can be measured using commonly available software in order to normalise the time taken for manual typing and error correction.</td>
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As part of the research, performance can be extrapolated by artificially inserting different error rates into various scripts and then gauging user performance, i.e., what performance level of transcription is needed for speech recogniser plus human manual correction to be more efficient than entirely human transcription.

The above controlled experiments will allow a mathematical model to be built which will predict what level of performance is required from the speech recogniser to satisfy a particular task.

Section Two:

Multi-Profile Parallel Transcriber

Aim

Performance evaluation of a custom made transcriber named Multi-Profile Parallel Transcriber.

Introduction

The multi-profile transcription prototype consists of two separate programs, the StreamingHost and StreamingGuest programs.

Each machine (virtual or physical) running the StreamingGuest program uses the Dragon NaturallySpeaking engine to transcribe utterances sent from the StreamingHost program.

The StreamingHost program is able to interface with multiple StreamingGuest programs to effectively transcribe utterance using multiple profiles simultaneously.

The StreamingHost program is able to collate the transcription results from all the StreamingGuest programs, and by using the confidence score provided by the Dragon NaturallySpeaking (DNS) speech recognition engine, is able to determine and display the most accurate result.

This method is required since the DNS speech recognition engine can only be instantiated once on the computer. To transcribe speech using multiple profiles simultaneously, multiple computers (virtual or physical) are required.

This is an unprecedented technique of transcribing from unknown speakers using Dragon NaturallySpeaking as a speaker-dependent speech recogniser. It effectively produces a large-vocabulary speaker-independent speech recogniser at an affordable price. Evaluation tests so far have shown that the Confidence Score used by Dragon for word recognition accuracy correlates well with NIST Sclice scoring.

Procedures

An existing Multi-profile transcriber prototype works. It can be used for performance evaluation experiments. However it is intended to upgrade the prototype that is written in Delphi so that it works with our current Windows 7 operating system and new version 12.5 of Dragon NaturallySpeaking. The revival requires a fast computer with multiple cores and large amount of RAM to be partitioned into many virtual machines. This requires the use of VM Ware plus Windows 7 licences.

The profiles created for the above-mentioned subjects are used for each virtual machine running the StreamingGuest program, live or recorded utterances from one or more unknown speakers are sent from the StreamingHost program to be transcribed simultaneously by the StreamingGuest programs. The StreamingHost program then collates the transcription results and, by using the Confidence Score provided by DNS is able to determine and display the most accurate results. The Confidence Score used by Dragon for word recognition accuracy is shown to correlates well with NIST Sclice.
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<td>IEP WCMD 01</td>
<td>EDINBURGH</td>
<td>Miniature Short Pulse High Power MOPA laser for LADAR applications</td>
<td>A diode-pumped crystal laser will be developed suitable for long range object identification by laser radar. Pulse widths in the 2 nanosecond region and pulse energies in the tens of millijoules will be required, along with extreme miniaturisation, suiting the master oscillator power amplifier configuration.</td>
<td>A literature search will be followed by a theoretical and experimental design process, leading to the selection of components, construction, and testing of a prototype laser with the required characteristics.</td>
<td>Crystal laser research and development.</td>
<td>Experimental skills in a laboratory environment. Due attention to occupational health and safety concerns. Presentation and communication skills.</td>
<td>The work will be conducted in the Laser Laboratory in the Electro Optical Seekers Group at DSTO Edinburgh using existing equipment and facilities, including access to local Defence facilities.</td>
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<td>IEP WCMD 02</td>
<td>EDINBURGH</td>
<td>Weapons Effects Vulnerability Code Development</td>
<td>Weapons Effects &amp; Protection Group (WEPG) is responsible for the evaluation of warhead performance and thereby provides the Australian Defence Force (ADF) with scientific and technical advice on platform vulnerability and weapon lethality (V/L). The research program employs complex modelling and simulation, supported by trials and experimentation. This project requires a contribution to the development of code and tools for performing V/L analysis. Outcomes are to be documented. The project offers exposure to several key knowledge areas including modelling and simulation, software engineering and project management.</td>
<td>Under direction, the successful candidate will implement changes to a development version of the V/L code WTI. Possible changes include improved functionality for weapons effects assessments, integration of DFT’s or other source code, writing new modules and GUI’s. The work will require a configuration management approach. This work will involve working in an international software development team. There may be an opportunity to be involved in experiments to validate the assessment code development.</td>
<td>Professional Software Development</td>
<td>• Good communication skills</td>
<td>The work will be conducted in the Laser Laboratory in the Electro Optical Seekers Group at DSTO Edinburgh using existing equipment and facilities, including access to local Defence facilities.</td>
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<td>IEP WCMD 03</td>
<td>EDINBURGH</td>
<td>Weapons Effects Modelling</td>
<td>Weapons Effects &amp; Protection Group (WEPG) is responsible for the evaluation of warhead performance and thereby provides the Australian Defence Force (ADF) with scientific and technical advice on platform vulnerability and weapon lethality (V/L). The research program employs complex modelling and simulation, supported by trials and experimentation. This project requires a contribution to various V/L assessments by performing modelling and analysis of the results of validation experiments relevant to the assessment scenario. Outcomes are to be documented. Tests may be conducted at various Defence locations around Australia. The project offers exposure to several key knowledge areas including modelling and simulation, trials planning and conduct, and systems engineering.</td>
<td>• Become familiar with the operation of the WTI V/L code. • Assist in developing CAD models for use in V/L modelling. • Perform a sensitivity study to determine the effects of CAD detail on V/L results. • Document the design, results and analysis • There may be an opportunity to be involved in experiments to validate the assessment code development.</td>
<td>Mechanical Engineering Disciplines</td>
<td>Good communication skills.</td>
<td>Some familiarity with types of military weapons and vehicles would be desirable.</td>
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| IEP WCMD 04  | EDINBURGH        | Tactical to Enterprise Integration Research | Defence's Information and Communications Technology (ICT) strategy states that the creation and adoption of an enterprise architecture is one of the foundations of its strategic imperatives. In support of this imperative, Defence is developing an Integrated Defence Architecture (IDA) that specifies three key domains that need to achieve seamless integration in the future: Military, Corporate and Intelligence. This research project will explore (and prototype/demonstrate) possible ways to integrate between systems designed for the Tactical/Military domain (e.g., Mission/Combat systems) with ones designed for the Intelligence domain (e.g., Enterprise information systems). | - Settling in and familiarisation with the DSTO research environment  
- Negotiation and scoping of the project  
- Research on Java EE technology and selection of an application server  
- Implementation of a small set of value-adding enterprise information services (to be negotiated)  
- Integration (in different ways) with the DSTO tactical test-bed  
- Instrumentation and testing of the performance differences between the different integration implementations  
- Analysis of the performance testing data  
- Reporting  
- Presentation to the group. | - Bachelor's degree in computer science, engineering or similar qualification. | - High proficiency in software development using the Java programming language is required. An applied exposure in Java Enterprise Edition technology is highly desirable. Understanding of component-based distributed computing, publish/subscribe frameworks or similar would be highly regarded. | - Highly motivated individual with an interest in research and development in the computer science/Engineering field. Able to work under a broad direction with good negotiating skills for scoping a problem and developing an exemplar solution. |