# Professional Development Reflection

**Company Description**

Defence Science and Technology Group is Australia’s primary research agency for supporting military branches acting as part of the Department of Defence. DST supplies science and technology support for Army, Navy, Air Force and many other Defence organizations. It also serves in an advisory role to the Australian Government, providing scientific expertise to issues regarding national security and future defence policy. DST employs 2300 staff in multiple facilities across Australia. There are eight research bases in places such as Edinburgh, South Australia, and Fisherman’s Bend in Melbourne. Other bases are located in Brisbane, Innisfail, Perth, Sydney, and Scottsdale.

DST is headed by the Chief Defence Scientist, a position currently held temporarily by Dr Todd Mansel. Operations are broken down into 7 Divisions:

* Land
* Maritime
* Aerospace
* National Security and ISR
* Cyber and Electronic Warfare
* Weapons and Combat Systems

These divisions focus on the development of different key areas within the Department of Defence. Within these Divisions are focus groups called CSTC’s, and within those are STC’s. These sub-groups focus on particular fields of interests relevant to the division that contains them.

**My Work**

At my time with DST I worked in Land Division as part of Advanced Vehicle Systems. AVS strives to enhance the capabilities of Land vehicles for deployment with the Australian Army. My research area focussed on adding new vision capabilities by investigating 360° video sensors for implementation on manned and unmanned vehicles. The original project was to integrate a 360° camera system with a Jackal UGV to demonstrate the capability. However, my research demonstrated that such an integration was infeasible and the technology would need to be implemented in a different platform.

My contribution was an assessment of specific 360° video hardware to determine key requirements in order to implement them effectively. This involved performance analysis and understanding of electronic and software factors that could potentially restrict the technology’s effectiveness. The final report I produced summarised my findings and presented a number of recommendations for future development that DST could use to continue research in the field. These findings will allow DST to make more informed decisions regarding 360° vision sensors, hopefully leading to full implementation in a suitable platform.

**Reflection**

This placement has taught me a great deal of new things about working as an engineer, particularly in a research environment. It has allowed me to develop new skills in software development, as well as how to conduct self-guided research. It also has helped me in developing a number of professional attributes need to appropriately conduct independent work without supervision, as well as practicing effective teamwork. Overall, I am pleased that this placement has left me feeling more confident in my abilities as an engineer, and more prepared to enter the workforce. It has given me a unique insight into a number of different processes in a national organization, something that is particularly on display at DST.

**Knowledge and Skills**

Upon commencing work at DST my knowledge and skill base was immediately put to the test. I was required to conduct a literature review relevant to my project field in order to gain the necessary understanding required to complete it. This involved reading through a number of technical documents describing the hardware and software I would be working on. I primarily was to be working on a project integrating the Ladybug5+ 360° camera with the Clearpath Jackal UGV. Therefore, I read a range of technical documents referring to both devices. I then needed to confirm that these devices would integrate with each other correctly, meeting all necessary power and connectivity requirements.

I was also required to broaden my conceptual and in depth understanding of software development in a number of ways. This first manifested itself when I was required to program using C# in Microsoft Visual Studio, as this was the only language the hardware I was using would support. I have had prior experience using C and C++, however this was always on Linux platforms operating out of the command line. Over the course of a month I progressed from a complete C# novice to understanding a range of key concepts that I am sure will prove incredibly valuable in the future. Not only was I able to produce functional code for the use of this project, but I was also able to gain insight into the software development processes used when programming on Windows. This is something I never would have learned throughout my academic studies unless I had deliberately sought it out.

My programming and software understanding were again extended when I was introduced to ROS. Given the aim to integrate the camera hardware with the Jackal UGV, I also looked into ROS as a whole, and ROS Indigo, the OS running on the Jackal. From this I was able to extend my conceptual understanding of what software drives autonomous vehicles, and how the industry has collaborated to produce an open source operating system for a range of platforms. Becoming properly informed of such an industry staple such as ROS is very useful as robotics and automation is playing an increasingly large role in the field of Electronic Engineering.

As work progressed on my project, I also gained valuable insight into the research directions within the fields of Virtual Reality and 360° imagery. I examined previous research conducted within my team at DST and their other attempts to implement technology such as distributed camera arrays paired with the Oculus Rift VR headset. I was able to learn where they had started from and what had been achieved, and thus where their work was heading towards.

**Application Ability**

When conducting work on my project, I applied a range of engineering skills in order to achieve the desired outcomes. From my studies of Project Management and Systems Engineering, I have been equipped with the tools necessary to tackle a project such as mine from a number of angles. I chose to approach the project from the perspective of client/contractor relationship. I spent time speaking with my supervisor to understand what he sought to achieve from this project. With this knowledge, I drafted a set of user needs as per the eXemplar Project Management System, which I followed using my prior experience from my studies. This led into a System Requirements Document that I used to outline what capabilities the desired system would deliver. It would become an important reference document when planning and managing the project.

The bulk of my work for this project was done independently, my supervisor allowing me to operate in almost complete isolation aside from reporting progress. On occasion he would provide feedback and direction, but for the most part the direction and methods used in the work were left to me to decide. This was an unfamiliar situation to me, as I have never worked independently on a project of such scope or duration before. As such, I developed a number of self-management skills to ensure I stayed productive and moving towards delivering the project results. This ability to work independently is something I believe will be incredibly valuable in future projects. In particular was the discipline of maintaining appropriate documentation despite being the only one working on the project. It would be easy to simply barrel on through work with my own notes, but by ensuring I have comprehensive documentation I can allow someone else to continue my work after I leave DST.

**Personal Attributes**

Another demonstration of developing personal attributes was in DST’s approach to working hours. As a government agency, DST utilises a system called Flexitime. Flexitime allows employees to decide their own working hours as long as they work between 8am and 6pm, and complete their allotted number of hours each week. Excess hours would become credit that can justify an absence at another date. Likewise, it is the employee’s responsibility to make up missing hours if they have not worked enough in a given period. This level of flexibility requires a degree of integrity and honesty to ensure it is applied fairly, as there are no immediate consequences for arriving late or leaving early from work. Where this applies to me is in exercising the self-management skills to keep atop this system and not fall behind in work. As mentioned before, I was working almost completely independently, so it was my responsibility to ensure I maintained my flex-hours correctly.

Ultimately the single most valuable experience with regards to my development of both knowledge and professional skills was my attendance at DSTEM 2019. This was a conference held at the University of Melbourne from 12-14th of February, where all SVP students and cadets presented their research. This was an outstanding opportunity as I got the chance to truly witness the breadth of research being conducted at DST across a range of fields from the Science, Technology, Engineering and Maths disciplines. These presentations demonstrated how new technology is being applied to solve defence problems. This included AI technologies to control drone swarms, to smart materials to enhance combat equipment for soldiers.

As part of the event, I also was required to present my research. This proved challenging as presentations had a strict 3-minute format, regardless of the size or complexity of the project. Despite this limit, I was pleased that I made a successful presentation that garnered additional interest during the questions afterwards. In doing so I exercised verbal communications in both a formal (presenting) and informal (Q&A) setting. This extended to further conversations I had during networking breaks across the event.

## Competencies Developed

**Knowledge and Skills**

* *Theory Understanding:* Employed basic principles to ensure device compatibility.
* *Conceptual Understanding*: Learned about C# dev,
* *In-depth Understanding*: Investigated ROS, Ladybug image processing, networking
* *Discernment:* Discovered 360 Video research space, VR research
* *Knowledge*: Learned about Design practice & systems engineering within DST
* *Understanding*: Understood Project scope and relevance, responsibilities to standards

**Engineering Application Ability**

* *Application of Engineering methods:* Utilised Sys Engineering/ Project Management methods to plan project
* *Fluent Application of Engineering techniques, resources:* Conducted research on field and iterative design planning (agile dev)
* *Systematic Synthesis and Design:* Utilised Sys Engineering/ Project Management methods to plan project
* *Systematic Conduct and Management:* Utilised Sys Engineering/ Project Management methods to plan project.

**Professional Attributes**

* ***Ethical Conduct:*** Responsibility to adhering to company guidelines, honesty with Flexitime
* ***Effective Communication:*** Written reports, Conference Presentation
* ***Creative Demeanour:*** Working independently to solve problems
* ***Professional info management:*** Maintained classification system
* ***Orderly Self-management:*** Honesty system in flexitime
* ***Effective teamwork:*** worked closely with Harvey to plan overall system