SILENTIUM DEFENCE
AN ON PROGRAM CASE STUDY

1

BOX 1   SILENTIUM DEFENCE CASE STUDY - EXECUTIVE SUMMARY

Key findings

The Silentium Defence (SD) project has produced the following outputs:

— SD's founders successfully negotiated the 'spin-off' of their firm from DST Group
— SD has developed a business plan
— SD has increased its marketing and knowledge building effort
   – All three services now cite Passive Radar as being a future science and technology requirement in their strategic guidance documents,
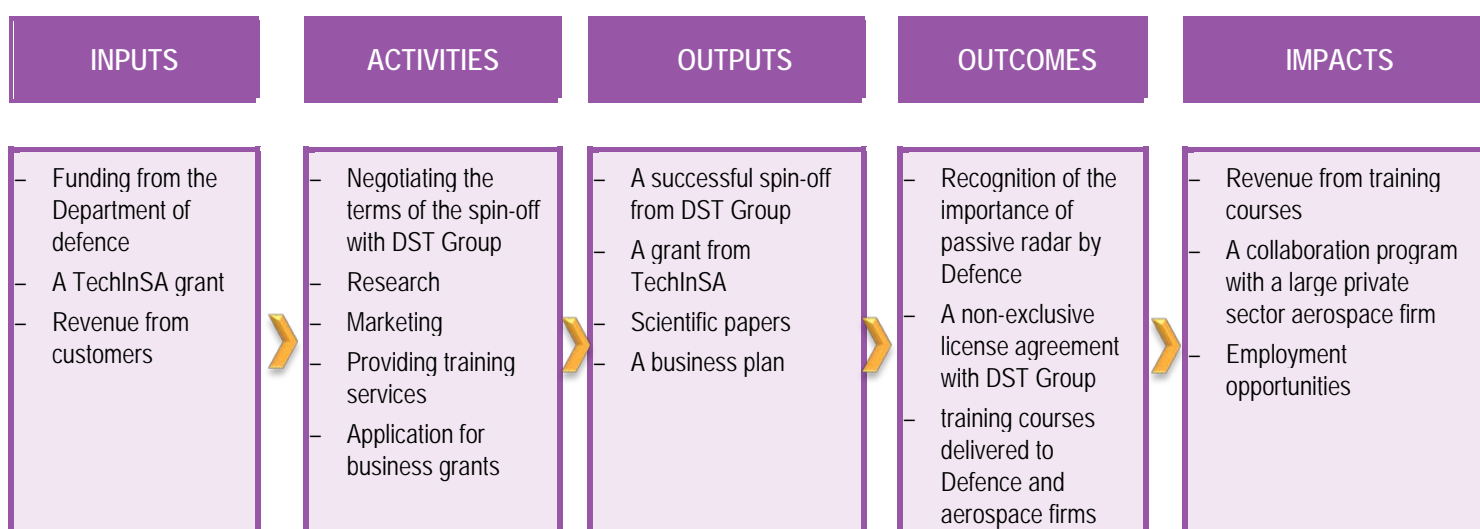— SD are now offering a suite of training services.

The ON program played an important role in helping to SD to emerge and survive as a start-up. The co-founders of SD themselves suspect that the firm may not have survived without the help of the ON program. While the potential future benefits from sales of SD's products could be very considerable, it is currently still too early to be able to quantify any benefit in a robust manner.

Role played by the CSIRO ON program

The ON program provided SD with important business and commercialisation skills and access to networks and mentors. In the absence of ON the founders believe that they would have struggled. One of the co-founders commented that he is not sure they would have survived as a start-up in the absence of the ON program.

This case study uses the evaluation framework outlined in the CSIRO Impact Evaluation Guide. The results of applying that framework to the Silentium Defence case study are summarised in Figure 1.

FIGURE 1.1   SILENTIUM DEFENCE CASE STUDY – IMPACT FRAMEWORK DIAGRAM

INPUTS	ACTIVITIES	OUTPUTS	OUTCOMES	IMPACTS
– Funding from the Department of defence – A TechInSA grant – Revenue from customers	– Negotiating the terms of the spin-off with DST Group – Research – Marketing – Providing training services – Application for business grants	– A successful spin-off from DST Group – A grant from TechInSA – Scientific papers – A business plan	– Recognition of the importance of passive radar by Defence – A non-exclusive license agreement with DST Group – training courses delivered to Defence and aerospace firms	– Revenue from training courses – A collaboration program with a large private sector aerospace firm – Employment opportunities

SOURCE: ACIL ALLEN

1.1 Purpose and audience for case study

This case study describes the economic, environmental and social benefits arising from the Silentium Defence project.

This evaluation is being undertaken to assess the positive impacts arising from the Silentium Defence project's participation in the CSIRO's ON. This case study can be read as a standalone document or aggregated with other case studies to substantiate the impact and value of the CSIRO ON activities as a whole, relative to the funds invested in these activities.

The information in this case study is provided for accountability, communication and continual improvement purposes. Audiences for this report may include Members of Parliament, Government Departments, ON, CSIRO and the general public.

1.1.1 CSIRO ON

CSIRO ON was established in 2015 by CSIRO to help accelerate the impact of science research into market. The initiative was expanded through funding from NISA to service more broadly Australia's publicly funded researchers and their industry partners. The aim of the initiative is to more quickly translate great science and technology research into positive impact to help address some of the economic, environmental and social challenges facing the Australian and global community.

There are a number of elements to the program, including two facilitated programs, ON Prime and ON Accelerate. These two elements are designed to complement each other.

ON Prime is an open and collaborative program for existing science projects as well as new technologies and projects that are still in development. ON Prime helps research teams to ensure that they are working on the right problem, it provides frameworks to create and test assumptions about their idea and provide recommendations towards next steps. ON Prime can be considered as an entry level program, in effect it can be seen as a precursor to participation in the ON Accelerate program.

ON Accelerate is designed for teams that have made significant progress with their idea and their target market(s). This may be in the form of contracts for paid or unpaid trials, or at the most advanced stage, recurring sales with both new and existing customers. This implies that teams will have a working prototype of their product or service and have secured any appropriate intellectual property rights. It is expected that teams applying for ON Accelerate would have conducted significant engagement with their potential customers and be able to demonstrate what they learned throughout, including what the total addressable market is and what competition exists.

For ON Accelerate, shortlisted applicants are invited to participate in a two-day Selection Bootcamp event where teams will be provided with training and coaching simulating the accelerator experience. At the conclusion of the selection bootcamp, the teams will pitch to a panel of external judges for a spot in the Accelerator. Projects that are at Investment Readiness Level (IRL) Stage 3 can apply directly for ON Accelerate without going through Prime or Bootcamp.

Following a team's passage through the ON Prime or ON Accelerate program they are eligible to apply for ON Runway support. That funding is designed to help teams to further progress their project. The support provided can be spent on a range of services, for example, regulatory certification, marketing, book keeping and or investor agreements.

1.2 Background

Silentium Defence is seeking to commercialise passive radar technology. This is a sensor technology that enables users to detect both emitting and non-emitting objects in congested electromagnetic environments, without adding additional energy to that environment and thereby avoiding detection themselves. Such a capability is seen as increasingly important by defence forces. Indeed, all three Australian services cite Passive Radar as being a future science and technology requirement in their strategic guidance documents, and therefore a future sensor requirement.

In addition, active radar requires the user to have access to dedicated spectrum. Getting access to this resource can be both difficult (in terms of the process) and expensive. For example, the 20 MHz of spectrum recently bought by Vodaphone cost $1.26 billion. By using passive radar users are able to maintain their situational awareness by accessing parts of the radio spectrum that might otherwise be unavailable for sensing due to their high cost. For example, FM radio, digital radio and digital television signals (or a combination thereof).

Passive radar also avoids the need to radiate energy which can have radiation hazard implications. By being able to operate without having to source a spectrum license for transmissions or create any zone(s) for protection against radiation hazard the cost of deploying and maintaining a radar system can be reduced.

Dr Palmer joined the Defence Science and Technology Group (DSTG) in 2006 and began his research into passive radar in 2007 together with his co-founder, Simon Palumbo. Over time the project went from being a very small scale project with only 0.1 to 0.2 FTEs to a multimillion dollar project. By August 2015 there were 6-7 FTE researchers plus 4-5 contractors working on the project.

In August 2016 the cofounders approached DSTG management to explore the possibility of commercialising the technology through a start-up. DSTG was supportive of the proposition and suggested that the Silentium Defence (SD) research team apply for the ON program. The team applied and was accepted into the boot camp that began in November 2016. Following the boot camp SD was one of the participants selected to move on to the Accelerator program. SD began the Accelerator program on 15 January 2017. They finished the program on 7 April 2017.

SD was incorporated as a Pty Ltd company just after the boot camp was completed and prior to Accelerate.

1.3 Impact Pathway

1.3.1 Project Inputs

Table 1.1 shows the support that has been provided to SD. As the company is very new, information is only available for 2017. While it is likely that there has been some in-kind support provided to the firm we have not been able to obtain any estimates of the amounts involved.

TABLE 1.1 SUPPORT FOR THE PROJECT

Contributor / type of support	2017 ($)
Cash	
TechInSA grant	200,000
Contract with Defence	100,000
Customers	Over $250,000
Total	Over $550,000

1.3.2 Project activities

One of the first activities by the Silentium Defence researchers was to negotiate an agreement between SD and DSTG regarding the intellectual property (IP) for the passive radar technology. That agreement was concluded and signed in September 2017. Under this agreement SD will pay DSTG a royalty on sales of its technology.

Assumptions for regular radar do not apply to passive radars, consequently one of SD's activities is providing training and demonstrations of the technology to a number of customers, including the Department of Defence and a private sector firm. The latter is to explore the use of passive radar technology in their business space. The contract has multiple phases and can be extended if the results warrant it. The payments from this contract are helping to provide the cash flow that Silentium Defence needs to continue the development its product.

SD sees two main market segments for passive radar, namely:

— *Defence.* SD believes it is more a question of when, rather than if, the technology is adopted by defence. Passive radar could potentially play a role in every defence platform. However, to break into this global market SD believes it will need to work with a Defence Prime.

— *Civilian.* There is less understanding of the technology in this sector. However, the private sector firm they are working with has been very supportive. Passive radar is currently more expensive than the inexpensive variants of short-range conventional radar (e.g. maritime radar for pleasure craft) but cheaper than medium to long range active radar systems. For air traffic control it is expected to be a less expensive option. The technology is not being pitched as a replacement to existing conventional radar but rather as an add-on.

SD successfully applied for a TechInSA grant from the SA government. This program provides support for early stage commercialisation. The grant provided $200,000 and SD were able to provide the required matching funds of $100,000 thanks to a contract with the Department of Defence. SD is also applying for a number of Defence Innovation programs (including the Defence Innovation Hub program).

Role of the ON program

The ON program helped SD to develop the IP agreement with DSTG. Prior to the negotiations with SD, DSTG had not negotiated with a spin off for a very long time and ON program staff warned SD that the negotiations could be challenging, which they were. However, DSTG adopted a positive approach to the negotiations and this, together the support and knowledge provided by the ON program, enabled an agreement to be reached.

The ON program also reset SD's perception about failing. SD researchers said that this was "liberating". One of the SD team noted that:

> *The ON program got us to think differently about what we were trying to achieve.*

ON also encouraged SD to engage with potential customers in a systematic manner and provided them with introductions to various parties. SD researchers noted that, importantly, those introductions were regarded by parties as highly "credible".

SD applied for and received runway extension services from the CSIRO ON program. In their case this included support from KPMG. KPMG assisted SD with legal matters, book keeping and preparing their business activity statements.

1.3.3   Project outputs

SD have prepared an initial business plan. Their business model does not rely on a single application, rather a mix of approaches will be adopted. This includes marketing their product and providing training services to different sectors. SD have engaged with all three Australian defence services to increase their awareness and understanding of the capability that this technology provides.

SD are also conducting market research with their customers to better understand their needs and to identify specific potential opportunities for SD products in the immediate future.

SD is planning to grow the business in a sustainable way. They estimate that they will need around 10 full time staff to progress (there currently have 4 full time and 3 part time staff).

Publications

Silentium Defence's cofounders have published over 50 papers. For example:
— Surveillance of Space using passive radar and the Murchison Widefield Array
— Opportunities and current drivers for passive radar research
— DVB-T passive radar signal processing
— Evaluation of adaptive filter algorithms for clutter cancellation in passive bistatic radar
— DSTO's experimental geosynchronous satellite based PBR

Patents

The passive radar IP is currently owned by the Commonwealth but is available under a non-exclusive license agreement that Silentium Defence has with DSTG. Under that agreement SD will pay DSTG a royalty on sales of its technology.

SD's own IP (software and algorithms which will be incorporated in systems hardware, possibly in collaboration with a manufacturer) is primarily protected via trade secrets.

Awards

The SD technology has not received any awards but one of SD's staff received a Stanford scholarship as a result of ON Accelerate

Innovation / commercialisation

The passive radar technology developed by SD has been tested in an environment very similar to that expected to exist in the actual market. However, commercialisation of the technology is still in its infancy. It is likely that SD will continue to provide training to various clients and further develop the technology. A capital raising is being considered. If the capital raising proceeds then it could take place between the end of 2018 and mid-2019.

It is likely that any sales of passive radar equipment will be done in partnership with a larger organisation, such as a defence prime. Any such sales are not expected to occur before 2019.

In terms of their total addressable market (TAM), SD has stated that:

It is difficult to estimate exactly the potential dollar value of this market, but it is likely to be measured in hundreds of millions to billions of dollars.[1]

The cost of conventional radar systems vary widely. For example, in August 2016 the airport on the island of Jersey reported that it had allocated 2 million pounds (about $3.5 million) to construct a replacement radar.[2] However, defence air traffic control systems are significantly more expensive. For example, an upgrade of the Australian Department of Defence's air traffic control facilities is reportedly costing over $400 million for new and upgraded facilities to be built at 13 bases and five off-base radar sites across Australia.

Another example of a potential use for passive radar is for wind turbine farm monitoring. Normally wind turbines have flashing lights on their towers to warn air traffic of their presence. However this makes for both light pollution and acts as an attractor for wild life which can be killed by the blades. Passive radar could be used to monitor air traffic in the vicinity and only turn on the lights when there are aircraft in the vicinity. The Clean Energy Council reports that there were 79 wind farms operating in Australia in 2017.

ACIL Allen is unsure about how to estimate the market for SD's services and products. Silentium Defence is still at a relatively early stage of business development. There is likely to be demand for SD's services but it is difficult to estimate how big that demand is likely to be. In the absence of better information a large number of assumptions would need to be made before a cost benefit analysis could be done. However, doing so would reduce the robustness of the case study and open it up to criticism.

Role of ON program

The ON program provided SD with important business and commercialisation skills and access to networks and mentors. In the absence of ON the founders believe that they would have struggled. One of the co-founders commented that he is not sure they would have survived as a start-up in the absence of the ON program.

1.3.4   Project Outcomes

Silentium Defence is still very much in its infancy. It will continue to provide training services to its clients (primarily defence and aerospace firms) and build partnerships with them with the aim of collaborating with them to eventually market passive radar systems.

Role of the ON program

The ON program helped SD to understand the nature of its market and the importance of understanding their customers' needs. It also provided mentoring and introductions that are helping SD to gradually grow their business. It also strongly emphasised the need for developing adjacent markets, an approach that the co-founders were less familiar with.

1.3.5   Adoption

SD's primary competition in Australia is a small-medium enterprise located in Adelaide. This company worked with SD at DSTG and is marketing its capabilities in this technology. However, SD believes it has a greater depth of expertise, broader client relationships and a better understanding of how to evolve the technology. SD is also aware of the applicability and viability of this technology in a greater number of applications (and therefore has a greater number of potential clients). As such they expect to be able to generate, service and support a bigger market then their Australian competitor.

There are also a number of large firms that are seeking to develop and market passive radar systems, for example, BAE Systems and Leonardo – Finmeccanica.

Australia is SD's initial target market in order to establish the firm's credibility. However, they are aiming to enter the global market as quickly as possible. To this end, they have already begun to investigate the requirements / obligations that need to be met for exports to be possible.

Role of the ON program

ON helped the co-founders better understand how important the non-technical differentiations are in identifying its value proposition and competition differentiation

---

[1] Silentium Defence ON program application.
[2] http://www.jerseyairport.com/News/Pages/radarreplacement.aspx Accessed 24 January 2018

1.3.6 Impacts

As Silentium Defence is still very much in the process of building its business the direct impacts at present are few and relatively minor in scale. Currently the main impact is the employment of researchers, trainers and other staff by SD. Indirect impacts include influencing the culture of DST Group. The demonstration of the 'spinning off' of a company from DST Group is leading others within that organisation to more seriously consider this path of technology transition.

If SD is able to capture some of the market for passive radar systems then more significant impacts and benefits will be delivered. These include:

— Revenue from sales of passive radar systems within Australia and potentially overseas.
— Avoided costs by radar installations being able to use existing radio frequency transmissions for the purposes of detection rather than broadcasting their own signal.
— Improved survivability of defence assets
— Less health risk associated with high power radio frequency transmissions.
— Improved community acceptance and licence to operate for radar stations
— Improved environmental outcomes through the reduction of bird deaths around wind farms.

Role of the ON program

Without the ON program there is some doubt that SD would have survived as a start-up. It also gave the co-founders a greater appreciation for the need to engage and communicate with Defence stakeholders (including DST Group) about the 'journey' of the start-up. This has been invaluable in maintaining their support through the process.

1.4 Clarifying the Impacts

1.4.1 Counterfactual

The ON program has clearly played an important role in helping to SD to survive as a start-up. The co-founders of SD themselves suspect that the firm may not have survived without the help of the ON program.

1.4.2 Attribution

At this time there is little or no quantifiable benefit from the Silentium Defence project. There is therefore little point in trying to determine any attribution of benefits.

1.5 Evaluating the Impacts

1.5.1 Cost-Benefit Analysis

At this early stage in the process of SD's efforts to commercialise their passive radar technology there is insufficient information to carry out a cost benefit analysis of this project.