Australian Government

Defence

National Manufacturing Priority road map

Defence National Manufacturing Priority road map

Our Vision

*An Australian defence manufacturing base that delivers **world-leading capabilities** for the Australian Defence Force (ADF) and is **internationally competitive**.*

*This stronger manufacturing base will be enabled by a larger number of **medium-sized** defence businesses that can secure long-term supplier relationships, contribute to and sustain Defence capability, and engage with small businesses.*

Our growth opportunities

Defence	International	Cross-sector applications
Leveraging investments and commitments to integrate emerging technologies and scale manufacturing of products and components supporting ADF priorities, such as: • drones/unmanned aircrafts • special military equipment including night vision goggles and combat protection	Expanding capabilities to service new and existing export markets with strategic partners (subject to regulations) in products and components such as: • armoured vehicles • advanced radar systems • patrol boats	Diversifying to cross-sector applications such as: • space domain awareness equipment including sensor networks • medical countermeasures including diagnostic tools and personal protective equipment

Our goals

2 YEARS

Manufacturers are investing more in addressing Defence priority capabilities and other market opportunities and have improved their linkages within the defence ecosystem.

5 YEARS

Greater manufacturing capability and increased participation in defence supply chains by Australian businesses. Smaller manufacturers are scaling up, creating the underrepresented 'middle' of the defence industry.

10 YEARS

More Australian businesses are contributing to local and international defence supply chains, while more Australian innovation and intellectual property (IP) is contributing to products supplied to the ADF and other markets.

Unlocking our opportunities—the first 2 years

***FOCUS**: Growing scale and competitiveness in the defence manufacturing sector through increasing commercialisation opportunities, supporting businesses to diversify into new sectors or markets and aggregating their capacities and expertise.*

Leveraging Defence investments and long term commitments	Diversifying to cross sector applications and exports	Connecting the defence manufacturing ecosystem
Commercialise or demonstrate late stage R&D activities that contribute to Defence priorities	Expand capabilities to service new and existing export markets and adjacent industries	Increase collaboration between primes and smaller businesses and scale more medium businesses

Contents

1. The Modern Manufacturing Strategy

The Australian Government is manufacturing a new future for our nation. Manufacturing is critical to a modern Australian economy—a key part of almost every supply chain that adds significant value to all sectors. The *Modern Manufacturing Strategy* (MMS) is led by industry, for industry, to help **manufacturers scale-up**, become **more competitive** and build more **resilient supply chains**. The Australian Government will be a strategic investor in this, notably through the 6 national manufacturing priority sectors, in order to drive productivity and create jobs for Australians, both now and for generations to come.

On 1 October 2020, the Australian Government announced a $1.5 billion investment in the MMS to help Australian manufacturers be more competitive, resilient and build scale in the global market. The 6 key areas of focus are:

Resources Technology & Critical Minerals Processing

Food & Beverage

Medical Products

Recycling & Clean Energy

Defence

Space

Through the MMS, the Government wants to support projects from industry that will transform manufacturing in Australia. The Defence National Manufacturing Priority road map will help inform investment decisions that both Government and industry make across the next 10 years to support projects that will:

- harness and grow the sector's strategic strengths and advantages
- provide innovative solutions to overcome constraints that limit value creation and that may prevent the sector achieving its full potential
- transform **the defence manufacturing sector** by facilitating the growth of a capable and sustainable industry. [1]

The MMS outlines the whole-of-government agenda to help grow Australian manufacturing and ensure our manufacturers can harness global opportunities and achieve scale. It is built on 4 pillars (Figure 1).

1 Note that "Defence manufacturing sector" in this road map refers to an industry that manufacture capabilities or supply related services to the ADF, defence industries or international clients and their supply chains.

Figure 1: Overview of the Government's Modern Manufacturing Strategy

Australia's Modern Manufacturing Strategy

GETTING THE ECONOMIC CONDITIONS RIGHT FOR BUSINESS	MAKING SCIENCE AND TECHNOLOGY WORK FOR INDUSTRY	FOCUSING ON AREAS OF ADVANTAGE	BUILDING NATIONAL RESILIENCE FOR A STRONGER ECONOMY
• Helping restore business confidence and recovery through the JobMaker plan • Delivering lower energy costs • Building management capability • Getting our tax settings right • Tackling red tape • Improve our industrial relations system	• Aligning research and innovation capabilities and programs to priority areas • Unlocking investment proposals through the Manufacturing Modernisation Fund round two • Backing digital transformation	• Setting National Manufacturing Priorities and developing road maps for action • Backing projects with wide reaching impacts through the Modern Manufacturing Initiative	• Making supply chains more resilient to external shocks including through a Supply Chain Resilience Initiative • Supporting global market diversification

Focusing on areas of advantage

The third pillar of the Strategy is to set National Manufacturing Priorities, develop road maps for action, and support projects through the Modern Manufacturing Initiative (MMI) which support the transformation of manufacturing in these sectors.

Road maps have been developed with industry to set out plans for both industry and Government to strengthen Australia's manufacturing capability. The road maps have been led by industry taskforces to identify and set a future vision for the priority areas with clear goals, opportunities and actions over the next 2, 5 and 10 years.

The road maps are designed to be dynamic. As the MMS is implemented, we will continue to work with industry to ensure the road map evolves over its life. This will take account of emerging opportunities and actions to support the sector to scale-up, become increasingly competitive and for businesses to integrate their commercial solutions with global supply chains and markets. See **Appendix A** for more details on the road map process.

The MMI aims to support manufacturers to more quickly bring their products to market and invest to scale their manufacturing operations in Australia and it complements other government programs to support the development of a strong and internationally competitive defence manufacturing sector.

Other pillars of the Strategy

The Modern Manufacturing Strategy includes 3 other pillars which will also be important to focusing Government investments to support the competitiveness and scale of Australian manufacturing.

Getting the economic conditions right (pillar 1)

The Australian Government is getting the economic conditions right for manufacturers, paving the way for growth and improved competitiveness in all sectors. Manufacturers need a pipeline of skilled workers as they transform and scale. The Government is investing $7 billion this financial year to keep apprentices in jobs, to help jobseekers re-skill and to promote vocational training. Reforms to higher education will boost the number of graduates in areas of employment growth, including in STEM. These policies are creating the jobs of the future and a pipeline of skilled workers to support new and emerging industries, including in manufacturing.

A gas-fired recovery will ensure Australian gas is working for businesses and manufacturers, with a 13-point plan and $49.8 million investment to unlock supply. This complements the Government's initiatives to reduce electricity prices, boost liquid fuels security and invest in low emissions energy technology through Australia's Technology Investment Roadmap.

The Government is harnessing opportunities from emerging technologies and building business digital capability, including growing Australian business' cyber security resilience. Work to implement a Simplified Trade System will support Australia's exporters and importers to invest and grow local jobs by making it easier for businesses to integrate into global supply chains.

Businesses are more likely to grow and attract investment when there are fewer barriers and they feel supported by a thriving business environment. That's why the Government is committed to getting the economic conditions right and creating collaborative environments which encourage the domestic and international market to invest; and partner with business, research organisations and state and territory governments.

The Government is focused on making and sustaining jobs through the JobMaker scheme. Our temporary full expensing of eligible depreciable assets and temporary loss carry back refundable tax offset measures will unlock investment and expand the productive capacity of the nation.

Making science and technology work for industry (pillar 2)

Australia's science, research and innovation capabilities are critical enablers of transformation in manufacturing. There is clearly an opportunity to find ways to improve the uptake of technology, processes and practices, and digital operations by manufacturers. These enablers support business competitiveness and will have positive spill-overs across our economy.

This work will focus our industry, science and technology investments, including through the work of the CSIRO, to support our National Manufacturing Priorities. This will help our manufacturers supercharge their operations and harness emerging opportunities.

It will also complement Government actions to harness opportunities from emerging technologies, build business digital capability and grow the cyber security resilience of Australian business.

Building national resilience for a stronger economy (pillar 4)

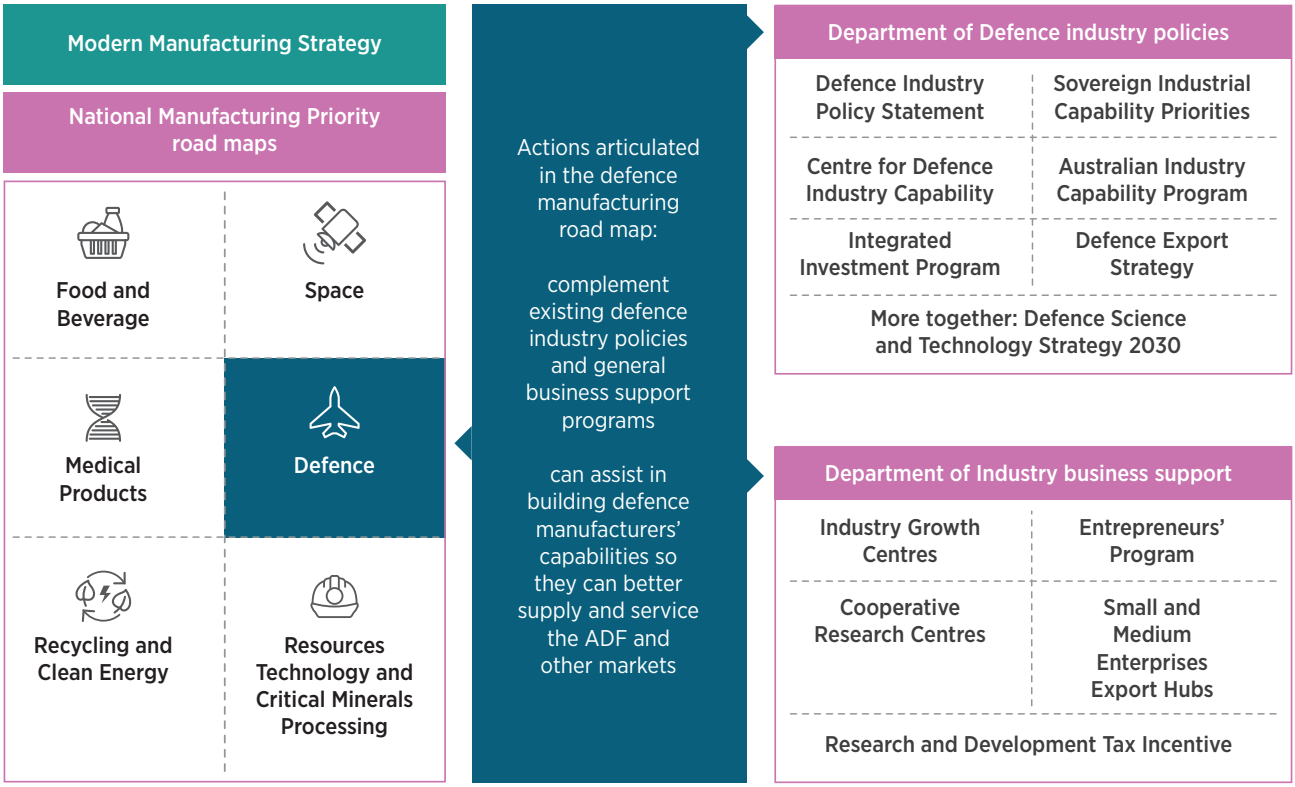
The Supply Chain Resilience Initiative will strengthen Australia's ability to access critical necessities, part of positioning Australia to respond to future supply chain disruptions to make us stronger and more resilient. It will build on Government and industry efforts to rapidly address critical supply issues revealed during supply chain disruptions due to COVID-19.

Overview of the defence manufacturing road map

This road map outlines the manufacturing growth opportunities in the defence sector and how Government will work with industry to deliver long-term transformational outcomes for the Australian economy.

This road map aligns with, and complements, the Government's existing strategic Defence and defence industry policy frameworks, leveraging existing programs to ensure a consolidated approach.

Figure 2: MMS alignment with current Australian Government initiatives and programs



The *2020 Defence Strategic Update* and *2020 Force Structure Plan* outline the strategic challenges Australia faces, and the capabilities the Government will develop to meet those challenges. These key strategic documents outline the importance of increasing our sovereignty and self-reliance, something we cannot achieve without a robust, resilient and internationally competitive defence industrial base in Australia. The *2016 Defence Industry Policy Statement* and *2018 Defence Industrial Capability Plan* outline the Government's steadfast commitment to growing this industrial base to achieve these greater levels of sovereignty; reaffirmed in the *Defence Strategic Update* and *Force Structure Plan*.

Manufacturing is crucial to delivering some of the Defence capabilities that will enable Australia to meet the challenges of the increasingly contested strategic environment. The Government has recognised the importance of these capabilities and announced $270 billion in funding for new and adjusted Defence capability to 2030, some of which will span manufacturing opportunities in Australia. This unprecedented level of investment represents opportunities for Australian manufacturing firms, and secure, long-term employment for Australian workers.

Defence manufacturing is underpinned by a range of high-end, leading-edge technologies and industrial capabilities. It is important to remember that defence manufacturing is part of the broader industrial base, and the capabilities and technologies that underpin defence manufacturing are in demand across other sectors. Growth in Australia's defence manufacturing capabilities will have spill-over benefits for the broader economy and will lead to increased capability for other National Manufacturing Priorities, and vice versa. However, these opportunities need to be considered against competition across sectors for sought-after skills and industrial capabilities. This is particularly the case as Defence capability and broader technology evolves and adopts Industry 4.0 technologies.

Australia is not alone in announcing significant investments in Defence capabilities, and this road map highlights export opportunities for companies involved in manufacturing in the defence sector. This includes the ability for businesses to partner with global primes on major projects, such as the F-35 Joint Strike Fighter and Hunter Class (BAE Type 26) Frigate, both of which have been adopted by a number of nations worldwide. By embedding itself in these global supply chains, Australian industry is more likely to access longer-term work, and additional export opportunities.

This road map details our vision for the Defence National Manufacturing Priority, the actions we will take to achieve that vision, and how we will measure our success to ensure we are on track. The road map also details the unique characteristics of the defence manufacturing sector in Australia, including challenges and opportunities and how they can be addressed.

This road map represents an integral element of the Government's Defence and industry policy agendas. Growing our manufacturing capabilities will be a crucial element for addressing supply chain issues highlighted during the COVID-19 pandemic and will increase our self-reliance and broader sovereignty.

2. Why defence manufacturing?

Defence manufacturing represents a key priority for the Government, as well as significant opportunities for Australian businesses. This includes:

- manufacturing the components and capabilities required for Defence acquisition and sustainment projects
- increasing our sovereignty and self-reliance
- integrating into global supply chains where businesses can export those components to our strategic allies.

Increased defence manufacturing will also deliver significant benefits for the broader economy. This includes opportunities for innovation, and businesses to generate scale and productivity by adopting Industry 4.0 technologies and to meet international demand and opportunities.

Domestic manufacturing businesses are already actively involved in supporting Defence. There is a concerted effort to develop enduring Australian Industry Capability, particularly relating to the Sovereign Industrial Capability Priorities. The defence manufacturing sector must continue to evolve and build its capabilities to seize opportunities, meet increased demand, and manage the complexity of the acquisitions requirements.

*In the context of individual **businesses**, capability generally refers to the ability of a business to develop and supply products or services. In a **Defence** context, it has a broader meaning, referring to the ability to achieve a desired effect in a specific operating environment.*

Significant economic contributor

Australia's defence industry is a significant economic contributor and has relatively high employment across each segment of the value chain (see Figure 4 for a schematic value chain). In Australia, it is a strongly growing sector because of increasing Government investment in Defence capability, creating substantial market opportunities. The Australian Government has committed $270 billion in new and adjusted Defence capability to 2030, and renewed its focus on ensuring that Australian industry can take advantage of the significant opportunities throughout the supply chain.

Defence industry is also a large employer of STEM professionals with an upwards growth trajectory in job numbers. [2] To deliver the Government's $270 billion investment in Defence capabilities over the next decade and beyond, the demand for Australian workers with technical, science and technology skills within Australia's defence industry will increase.

Preliminary analysis of the sector indicates that Australia's defence industry is growing, with over 4,000 businesses collectively employing approximately 30,000 staff. An additional 11,000 Australian companies directly benefit from Defence investment, and when further downstream suppliers are included the benefits flow to approximately 70,000 workers in total. [3]

2 Defence Industry, The Workforce Behind the Defence Force, accessed 12 February 2021.
3 Department of Defence, 2020 Defence Strategic Update, July 2020, p. 46.

Pathway to growing global markets

Growth in Australian defence spending mirrors global trends. According to the Stockholm International Peace Research Institute, total global military expenditure rose to $1,917 billion in 2019. This represents an increase of 3.6% from 2018 and the largest annual growth in spending since 2010. [4] While defence expenditure globally was expected to further grow between 3% and 4% in 2020, [5] the impact of the COVID-19 pandemic means that it is now expected to remain stable into 2021. [6]

Building on our existing manufacturing strengths, these investments can provide Australian businesses with access to long-term strategic projects and some of the world's most advanced global supply chains. They are also a signal to industry of the ongoing need to develop, commercialise and merchandise advanced technologies and for the application of agile business and production models.

The defence industry provides Australian companies with opportunities to enter global supply chains either themselves, or facilitated by primes (large multinational companies). The Australian Government has well established Australian Industry Capability requirements, whereby prime contractors wishing to compete for Defence tenders over certain thresholds are required to identify Australian suppliers. In instances where a project aligns with one or more of the Sovereign Industrial Capability Priorities, but where the capability does not exist in Australian industry, tenderers must demonstrate how they will transition this industrial capability to Australia.

The Defence Export Strategy sets out policies and initiatives to provide end-to-end support for defence industry to export; from building export readiness, to identifying export opportunities and ultimately realising export outcomes through to 2028. The Strategy is implemented through the Australian Defence Export Office.

Source of innovation

Defence is a significant player in the Australian publicly funded innovation environment. In 2019-20 the Defence Science & Technology Group Research and Development (R&D) activity accounted for 4.9% of the Australian Government's investment in R&D ($469 million). [7] Defence Science and Technology Group (DST Group) is Australia's second largest Government-funded science organisation after the CSIRO, and employs approximately 2,300 staff with a presence in nearly every state and territory. [8]

The importance of science and technology in the future of the Australian Defence Force (ADF) was established in the *2016 Defence White Paper* and reaffirmed in the *2020 Defence Strategic Update* and *Force Structure Plan*. Defence, Australian defence industry and the Australian research community have a strong track record in collaborating on leading-edge innovations to bolster ADF capabilities as well as maintenance of those capabilities.

Building on this success, the Force Structure Plan outlines $3 billion of investment in science, technology, research and innovation.

Recently, *More together: Defence Science and Technology Strategy 2030* introduced 8 large scale science and technology (S&T) missions, 'STaR Shots', to set the direction for strategic R&D. [9] They are:

- Resilient multi-mission space
- Information warfare
- Agile command and control
- Quantum assured position, navigation and timing (PNT)
- Disruptive weapon effects
- Operating in chemical, biological, radiological and nuclear (CBRN) environments
- Battle-ready platforms
- Remote undersea surveillance.

STaR Shots will be supported though additional investments including in modelling and simulation, prototyping and trials.

4 SIPRI: Global military expenditure, 27 April 2020, accessed 11 February.
5 Deloitte, 2020 Global aerospace and defence industry outlook, 2019.
6 Deloitte, 2021 aerospace and defence industry outlook, 2021.
7 Department of Industry, Science, Energy and Resources, 2019-2020, Science, Research and Innovation (SRI) Budget Tables, accessed 1 February 2021.
8 Department of Defence, Discover DST, accessed 22 December 2020.
9 Department of Defence, Defence Science and Technology Strategy 2030, 2020.

These strategic investments also represent significant R&D opportunities for establishing advanced manufacturing products and processes within Defence. For example, the 'disruptive weapon effects' priority is seeking to develop new, intelligent weapons, smart missiles and advanced warheads. The 'remote undersea surveillance' priority seeks to develop integrated sensor systems, and apply autonomous systems to underwater and marine operations.

The Next Generation Technologies Fund engages Australian industry, universities and research organisations to research emerging and future technologies with the potential to deliver new capabilities for Defence. It will invest in R&D in emerging and future technologies in 9 priority areas, including space capabilities, medical countermeasures and quantum technologies.

Besides anticipating and preparing for the future, Defence science and technology helps the ADF and broader Defence community to respond to current and emerging issues. For example, DST Group is part of Australia's response to COVID-19, and together with an Australian manufacturing company, rapidly developed, prototyped and produced face shields for Australian medical personnel. [10]

This strong public investment in defence innovation and R&D represents a significant opportunity for establishing a strong, capable and sustainable manufacturing sector to support the defence industry.

Industry structure: understanding the current landscape

The Australian defence industry is unique, with specific challenges and opportunities. Its size, structure, composition and capacity is largely shaped by Government demand. The primary objective of the industry is to deliver and sustain Defence capability to advance Australia's national interests, security and prosperity. Australian industry was formally recognised as a fundamental input to capability in the *2016 Defence Industry Policy Statement*, which emphasises the importance of the defence-industry partnership.

Defence industries involve both specialised technical and cross-sector transferable capabilities. It is defined not by a skillset, capability or type of work, but by the end customer. Defence supply chains comprise a diverse number and types of businesses. For many of these businesses, Defence is not the primary customer and they may not identify as being part of the supply chain.

The Australian defence industry is currently made up of a large number of small businesses, relatively few medium sized businesses, and a few primes. Australian industry representatives, including the Defence manufacturing road map taskforce have noted the 'relatively low number' of medium sized defence businesses as an ongoing challenge for building sovereign defence industrial capability.

State and territory governments, as well as defence industry associations are also important parts of the broader defence industry ecosystem with jurisdiction-specific strategies to create a thriving local defence industry. Research organisations such as CSIRO and Australian universities conduct R&D that contributes to Defence capabilities.

Defence manufacturing is a subsector of the broader defence industry. For the purpose of this road map, the sector is defined as:

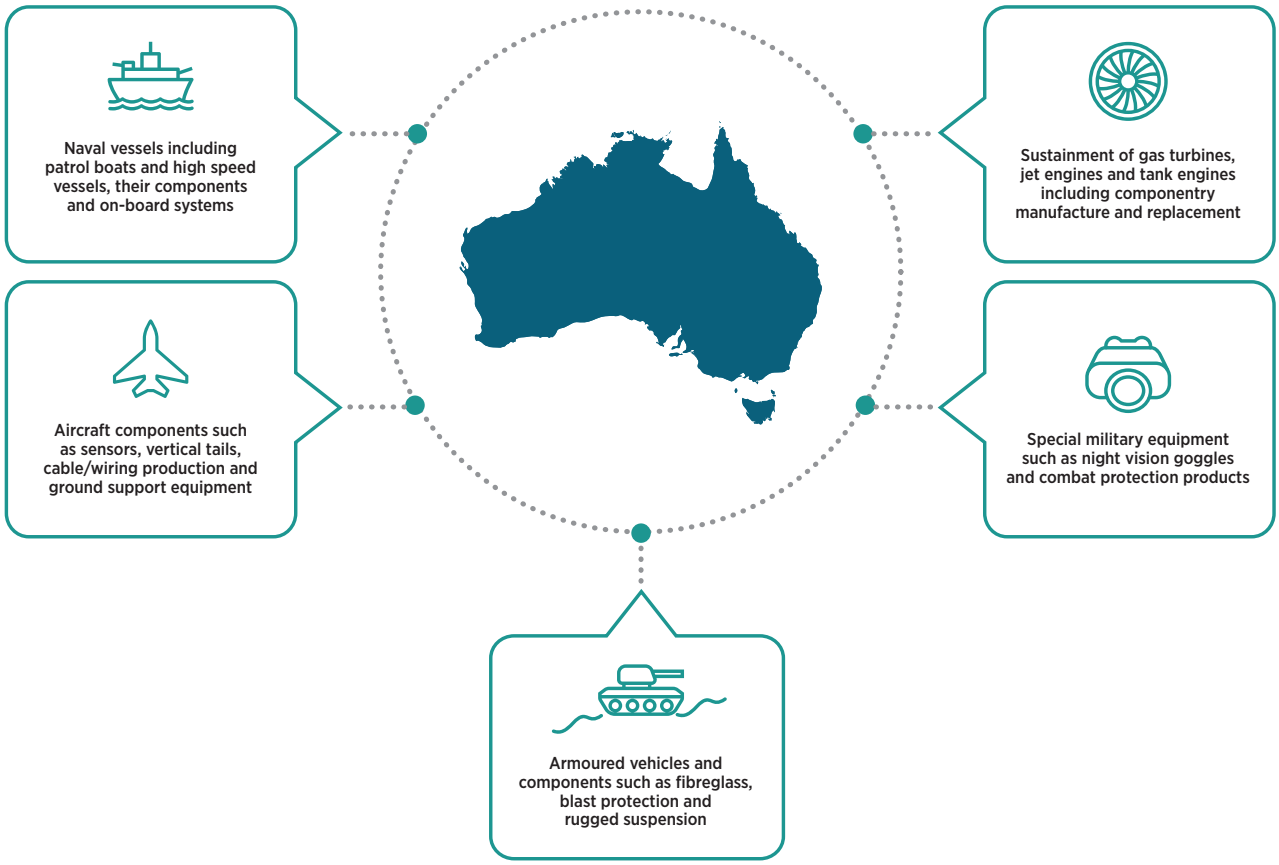
Companies or organisations that manufacture capabilities or supply related services to the ADF, defence industries or international clients and their supply chains.

The unique characteristics of Australia's defence manufacturing sector are:

- The Australian Government is the key end customer and investor into the sector and sets overarching strategic polices that inform the domestic demand.
- A small number of large international companies known as primes lead in delivering the majority of contracts, subcontracting small and medium enterprises (SMEs).
- Strict quality assurance frameworks and high security requirements.
- Businesses need a proven capability to deliver.
- Exports are subject to Australia's export control legislation.

10 Australian Defence Business Review, Feature: STaR SHOTS, July 12, 2020, accessed 24 February 2021.

Figure 3: Australian defence manufacturing strengths



Areas of existing strength in Australian defence manufacturing

Australia has world-class capabilities in several defence manufacturing subsectors:

Armoured vehicles

Based on the strong skills base from the local auto industry, Australia currently designs and manufactures several types of military vehicles, their bracketry and components, including for export, utilising capabilities to fabricate and weld specialised metal components to military standard. Australian suppliers are recognised for innovations such as high-speed welding technology and robotic welding that enable the use of ultra-hard steel plates in the vehicle construction.

Aircraft manufacturing and sustainment

Australia's geographical isolation and sparse population were the initial drivers of the establishment of the aerospace sector, which has since built a strong international reputation. Defence is one of its main subsectors utilising capabilities in metal and composite component manufacture and assembly.

Naval shipbuilding

Similarly, shipbuilding has a long tradition in Australia. Australian marine equipment and accessory manufacturers are globally recognised for a diverse range of marine hardware, components and accessories, including winches, radars, buoyancy aids, autopilots and dock flotation systems. [11] This subsector has been significantly strengthened by the Government's long-term commitment to continuous build and sustainment of major warships and minor naval vessels in Australia.

Other sectors

Beyond the above broader subsectors, Australian defence manufacturers have capabilities in specific high-tech niche areas. These include specialist military equipment such as munitions and small arms which integrate traditional manufacturing with cutting-edge digital technologies, such as 3D printing, and utilise capabilities such as explosive ordnance and energetic materials manufacturing.

Government investment and policy settings

Unprecedented investment

The Australian Government has provided Defence with long-term funding certainty. The Defence budget has met its target of 2% of GDP. It will be de-coupled from GDP forecasts to avoid the need for adjusting Defence's plans in response to future GDP fluctuations, and providing long term funding stability for both Defence and Defence industry. Defence is forecast to spend $270 billion over the coming decade on new and adjusted Defence capability.

The large increase in investment creates potential for a substantial increase in demand for Australian defence manufacturing. This could occur in:

- acquisition: constructing new capability, such as land vehicles or maritime vessels
- sustainment: maintaining, repairing, overhauling and upgrading existing equipment including the manufacture of spare/replacement components (Figure 4).

Historically, Australian Government has spent a larger portion of its sustainment locally in Australia, compared to acquisition.

The higher local spend on sustainment reflects that:

- Australia has traditionally acquired mature and proven Defence capabilities
- sustainment activity provides long-term opportunities for industry to support Defence capability in Australia in close partnership with operational units
- the Government's commitment to providing opportunities for Australian industry.

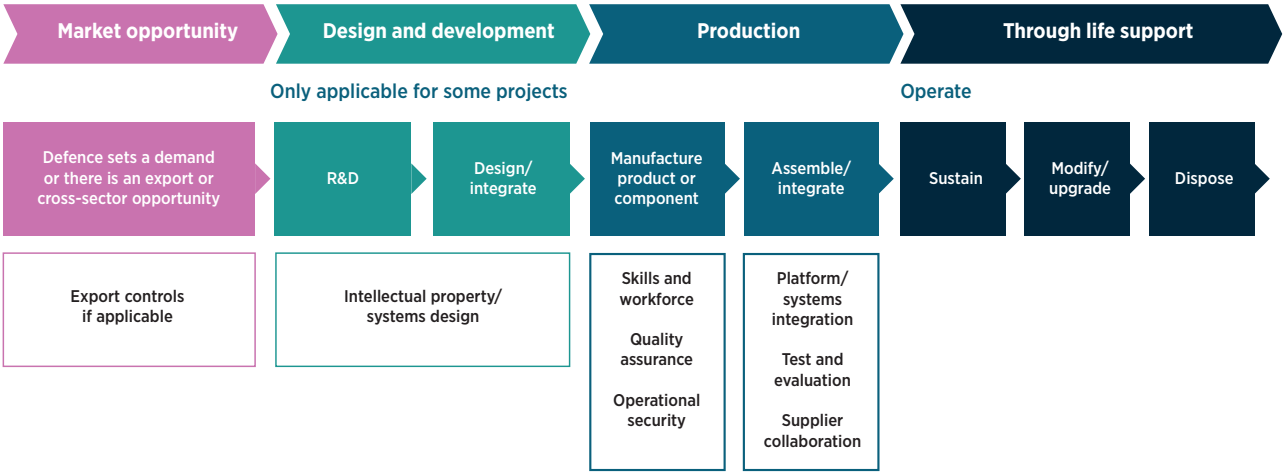
Participation in sustainment activities also enables effective management of operational requirements.

An example of a significant sustainment project is the Collins Class submarines ongoing support contract. A team of scientists and engineers are developing and implementing upgrades to the submarines to ensure their operational readiness. An example of how advanced manufacturing contributes to sustainment is the use of additive manufacturing for in-situ repairs of submarines. [12]

11 Austrade, Australian industry capabilities, accessed 4 March 2021.

12 ASC News: ASC and partners to pioneer additive manufacturing for submarines, 1 June 2020, accessed 1 March 2021.

Figure 4: A schematic defence manufacturing value chain [13]



Focus on ADF capabilities

The Australian Government has identified its priorities for the defence industry through a set of foundational documents. They identify the critical capabilities for the ADF—not specific technologies or businesses—and communicate to the business community, including Australian manufacturers, the future demand for industry. This increase in transparency, clarity, and early engagement enables Australian defence industry to consider Defence's capability requirements. They can then structure their business and undertakings to be in position for future procurement opportunities.

This road map complements Defence's industry policy settings. These aim to develop a strong, sustainable and secure Australian defence industry to ensure Australia is able to act with greater independence in an increasingly contested strategic environment. There are a number of Defence and broader Government policies and programs relevant to the Defence National Manufacturing Priority (see Figure 5).

Defence industry policies are supported by a number of programs that target the local innovation and commercialisation pipeline, and help to link Australian businesses to the Defence ecosystem. See **Appendix A** for further information on defence policies and programs.

13 Adapted from the SICP Implementation Plan / Land combat and protected vehicles and technology upgrades, page 24.

Figure 5: Overview of defence industry policies [14]

Defence Capability Cycle	Australian Industry Capability Program	Centre for Defence Industry Capability	Defence Innovation Hub	Next Generation Technology Fund
Ensures Australian industry contribute more directly, earlier and throughout decision-making about Defence capability.	Frames and guides Australian industry participation in major projects.	Supports small and medium sized businesses entering or working in the defence industry.	Funds the development of innovative technologies with the potential to enhance Defence capabilities.	Focuses on research and investment related to leading-edge-technologies.

Australian Defence Export Office	Defence Industry Security Program	Defence Policy Industry Participation	Sovereign Industrial Capability Priority Plans	National Defence Industry Skills Office
Provides tailored assistance and targeted level support across all stages of a company's export journey.	Certifies Australian businesses in relation to Defence security requirements for consideration in Defence projects.	Maximises opportunities for Australian and local industry involvement across Defence material and non-material procurement.	Provides guidance to industry for corporate planning and investment related to Defence's industrial capability priorities.	Acts as the single point of contact for industry skilling and STEM-related engagement and leadership.

The MMS will build on these existing policies and initiatives with a focus on opportunities for defence manufacturing in priority areas which have been identified by Defence. These priority areas include Sovereign Industrial Capability Priorities – for details see **Appendix A**.

The MMS will assist Australian manufacturers to develop the capabilities required to take advantage of relevant defence market opportunities, domestically and globally. It will also help Australian manufacturing to achieve scale, especially as it delivers through projects related to Defence's Sovereign Industrial Capability Priorities.

14 Department of Defence, Review of the Centre for Defence Industry Capability, July 2020, p. 15 for diagram.

Barriers to scale

The specific characteristics and sensitivities of Australia's defence industry place particular demands and specific requirements on manufacturers. Consultations with the taskforce and other industry and Government stakeholders as part of the road map development identified some of the following barriers to achieving competitiveness and scale in the defence manufacturing sector:

- It is challenging for non-defence and small businesses to enter the defence manufacturing sector, access supply chains, and navigate the broader defence industry.
  - Many initiatives helping businesses to enter the defence industry are delivered and coordinated through the Centre for Defence Industry Capability. This road map also notes that work is required across all levels of governments to help businesses to navigate the defence environment.
- Defence procurement is cyclical and may be low volume and drawn out at times. This can make future planning and forecasting for manufacturing businesses uncertain.
  - Diversifying into exports or cross-sectoral markets can provide business continuity. These aspects are discussed further in this road map.
- Breaking into exports is a challenge for Australian businesses, especially for those who have not provided services or products to the ADF. Many countries support their own industries via offset requirements, and exports of sensitive technology may be subject to export controls. [15]
  - The Department of Defence and Austrade assist aspiring and active defence exporters to access overseas markets, and navigate the relevant regulations.
- The ADF has high quality and technology maturity expectations for delivery of Defence capability. The products for Defence often require adherence to specific standards which are hard, especially for small businesses, to implement (for example, accreditations requirements, such as quality management system ISO 9001). [16]
- High security requirements for Defence projects can include physical security of people, information and assets. Cyber security particularly is a challenging issue for businesses in the defence industry supply chain, with an increased risk of cyber attacks due to the sensitivity of their projects.
  - The Defence Industry Security Office manages programs that support businesses to meet their security obligations for defence projects, including cyber security. This road map provides opportunities for businesses to address related infrastructure barriers.
- Improving R&D and commercialisation activities to be more targeted to achieve greater scale.
- Commercialising specialised defence products and technologies is resource intensive, with opportunities to better align R&D funding to support new initiatives.
- The sector is predominantly made up of small firms that may not have the necessary resources to invest in commercialising their ideas or upgrade their facilities or processes. Growing the number of Australian larger, medium-sized defence manufacturing businesses is a key objective for this road map.

Additional barriers to scale for defence manufacturing are discussed in **Appendix B**.

15 Offsets requirements are where a company may be required to reinvest a portion of the contracted amount into the purchasing country. Transparency International Defence & Security, Defence Offsets: Addressing the risks of corruption and raising transparency, April 2010, p.6.

16 See Protective Security Policy Framework, Defence Security Principles Framework and the Australian Government Security Manual.

Challenges for defence exports

Breaking into exports is a challenge for Australian businesses, especially for those who have not provided services or products for the ADF before, since overseas buyers often want to acquire tested products that are already used by military. The Government acknowledges this and has established the *Defence Export Strategy* to help businesses access potential international defence markets. [17] Many countries also implement offset programs that mandate local content when awarding large contracts.

In addition, those intending to participate in defence-related manufacturing need to comply with Australian and foreign export controls. Australia's export control laws are in place to enable responsible export, supply, publication and brokering of military and cross-sector goods and technologies. A permit is required for the export of controlled military and dual-use items and technology. Exporters also need to take into consideration conditions attached to any foreign technology they have access to. Equipment, data or services procured from another country, such as the United States (US), may be subject to specific access, re-export and retransfer obligations.

The Government recently strengthened its foreign investment framework through reforms to the *Foreign Acquisitions and Takeovers Act 1975*. These reforms introduced or amended measures to assess foreign investment proposals into sensitive national security businesses, particularly those that provided goods and services to Defence. Businesses in, or seeking to enter, the defence industry need to consider these reforms where foreign investment is sought or proposals are received.

To help businesses navigate the export regulations and foreign markets, the Defence Export Controls and Austrade provide relevant information. The Defence Export Controls within Defence is Australia's military and dual-use goods and technology export regulator and raises awareness about export control law and its applications. [18] Austrade and the Australian Defence Exports Office within the Department of Defence assist businesses by identifying partners for Australian businesses, identifying customers, providing support for in-country visits, and helping businesses establish an overseas presence.

Opportunities

This road map seeks to address defence manufacturers' challenges by highlighting opportunities for Australian manufacturers to build scale and capability. It outlines actions to support businesses to collaborate and commercialise and enhance their ability to integrate into domestic and global supply chains.

Rather than identifying specific subsectors for growth, this road map identifies opportunities for defence manufacturers in 3 key areas:

1. **Defence: Leveraging Defence investments and long term commitments to integrate emerging technologies and scale manufacturing.**
2. **International: Expanding capabilities to service new and existing export markets with strategic partners.**
3. **Cross-sector applications: Diversifying to cross-sector applications – both spin-off and spin-in.**

These opportunities also create the conditions for small businesses to scale, and in particular, to grow the medium sized defence businesses that will bolster the sector's capabilities as a whole. Medium sized businesses have a central role in defence supply chains and enable the sector as a whole to achieve scale, as they are in a position to:

- more likely develop and / or own their intellectual property (IP) and scale
- take some bigger subcontracts from the primes
- engage directly with Defence
- incorporate small businesses in their supply chains.

17 Department of Defence, Defence Export Strategy, 2018.
18 Department of Defence, Defence Export Controls, accessed 9 March 2021.

3. Vision—Defence Manufacturing

An Australian defence manufacturing base that delivers ***world-leading capabilities*** *for the Australian Defence Force (ADF) and is* ***internationally competitive****.*

This stronger manufacturing base will be enabled by a larger number of medium-sized defence businesses that can secure long-term supplier relationships, contribute to and sustain Defence capability, and engage with small businesses.

Australian manufacturers are in a prime position to take advantage of the increased domestic and global investments in Defence capabilities. The numerous acquisition and sustainment opportunities that will come from these investments will support manufacturers to:

- make up a greater share of the defence supply chain
- enter new markets beyond the ADF
- contribute to some of the world's most advanced supply chains and export to allies or like-minded countries.

These opportunities will be for both the defence industry and adjacent sectors, such as mining, medical, space or law enforcement.

This future will be built on existing capabilities within Australian manufacturing, unprecedented investments in Defence capabilities by the Government, and investments in applying our internationally recognised R&D to create new goods and services. Leveraging these investments, deepening collaboration to grow industry capabilities and commercialising innovations will help manufacturers scale their operations and improve their competitiveness in the global market.

The co-investments by governments and industry made through the MMI, as well as the policy initiatives across different level of governments, will progressively grow the defence manufacturing sector as follows:

2 year vision

Manufacturers are investing more in addressing Defence priority capabilities and other market opportunities and have improved their linkages within the Defence ecosystem.

5 year vision

Greater advanced manufacturing capability and increased participation in defence supply chains by Australian businesses. Smaller manufacturers are scaling up, increasing the number of medium-sized defence manufacturing companies.

10 year vision

More Australian businesses are contributing to local and international defence supply chains, while more Australian innovation and IP is contributing to products supplied to the ADF and other markets.

4. Growth opportunities

A key goal for the Australian Government over the next decade is growing Australian defence industry supply chains at the right pace and scale so that they can support the required delivery of high-quality Defence capabilities. Achieving this goal requires continued concerted actions from Government and industry to increase the involvement of Australian businesses in local defence supply chains and support businesses to scale-up and become medium and large sized enterprises.

Entering into supply chains requires forming new client relationships and adapting to new value networks. In some cases, it requires developing new products and services while adhering to rigorous security and quality standards.

Accessing defence supply chains not only provides direct benefits in terms of income from a specific project but can also increase the ability of businesses to scale-up operations. In some cases, participation in a defence supply chain may lead to opportunities in other defence projects or opportunities in defence exports and civil sectors. These opportunities allow defence manufacturers to undertake further development and capability improvements, and can support improved access to upper parts of the value chain.

Through detailed analysis, public consultation, drawing on industry experts' views and reports, this road map outlines the key growth opportunities that defence manufacturers can seize.

To unlock and maximise these opportunities, defence manufacturers will need to invest in advancing their capabilities, including productivity, skills, innovation and regulatory and standards compliance.

Key areas of opportunity

Defence	International	Cross-sector applications
Leveraging investments and commitments to integrate emerging technologies and scale manufacturing of products and components supporting ADF priorities, such as: • drones/unmanned aircrafts • special military equipment including night vision goggles and combat protection.	Expanding capabilities to service new and existing export markets with strategic partners (subject to regulations) in products and components such as: • armoured vehicles • advanced radar systems • patrol boats.	Diversifying to cross-sector applications such as: • space domain awareness equipment, including sensor networks • medical countermeasures including, diagnostic tools and personal protective equipment.
Enablers of growth: IP ownership, Industry 4.0 technologies, cyber security and promotion of existing Government support programs.		

Opportunity: Defence

This opportunity will seize on the extensive Government investment in the defence sector and opportunities to manufacture goods to supply the ADF with capabilities identified by the Government and Defence such as the Sovereign Industrial Capability Priorities. [19]

The manufacturing opportunities will build on the extensive Government funding and existing defence policies to support Defence to achieve its objectives, while building greater capacity and capabilities in our manufacturing sector.

Examples of Defence market opportunities for manufacturers

Australian Defence manufacturers can leverage the large Defence investments and long term commitments to scale their capabilities in the manufacture of products and components contributing to Defence priorities such as: [20]

- **advanced materials**: To maintain a warfighting advantage it is necessary to develop and integrate advanced materials, protective element technologies, and advanced multi-functional textiles. This is primarily delivered through protective technologies in the form of helmet systems, soft insert technologies, and hard armour plates, and using materials such as advanced ceramics, composites and advanced textiles.
- **design and integration**: The ability to integrate advanced, multi-functional materials into the design of the soldier combat ensemble will allow for stronger, lighter, and more durable materials, coupled with cheaper, lower-energy production and manufacturing methods.
- **signature reduction**: The ability to develop signature reducing multi-spectral fabrics, coatings and materials. This includes the continued exploitation of protection equipment and advanced textiles to integrate signature reducing technologies.
- **precision specialist machining**: Precision specialist machining, treatments and coatings of components using advanced lightweight materials to support the assembly and sustainment of small arms and ancillaries.
- **protection technologies**: Design, development and industrialisation of survivability and signature reduction material technologies and processes for land combat and protected vehicles.
- **sustainment**: The ability to forecast land combat and protected vehicles maintenance requirements; undertake platform, system and sub-system maintenance; and vehicle upgrades and updates. This is enabled by data, a highly skilled technical workforce, and fit-for-purpose Australian infrastructure.
- **tactical sensor integration**: Integrate tactical sensor hardware and software with host platforms, other sensors and control systems (including combat management systems) and certify integrated sensor networks for operational use.
- **high frequency sensor technologies**: Design, develop, and sustain active and passive high frequency sensors for long-range persistent air and maritime surveillance, including advanced adaptive algorithms for resilience and assured performance in degraded conditions.
- **secure communication technologies**: Design, develop, modify, and upgrade software and hardware that enable secure communication across the Joint Force.
- **platform signature management test and evaluation capabilities**: Ability, skills and equipment across industry to test and evaluate signature management technologies, including physical and electronic signatures of military platforms, in all operating environments.

19 Department of Defence, Implementation and Industry Plans, accessed 11 March 2021.

20 *Note: the example lists in each of the opportunities sections draws heavily from the critical industrial capabilities in the Sovereign Industrial Capability Priority (SICP) Implementation Plans that have been released to date. These were chosen as they represent Australian Government's agreed priorities for the defence industry base. This list is current at the time of writing, and is subject to change as future SICPs and Implementation Plans are announced and released.*

Opportunity: International

Exporting defence products to strategic international partners

Exporting provides Australian defence manufacturers with greater certainty of demand and investment to support growth and innovation. Australia is well placed to continue building a strong export sector and utilise our existing strengths:

- world class research base
- trusted trading partner
- geographic location supporting advanced communications
- existing advanced manufacturing expertise in adjacent sectors which can support defence manufacturing such as automotive and shipbuilding
- well-regarded cyber security standards
- expertise in robotics and automation, especially in autonomous systems and remote asset management stemming from expertise in mining operations
- expertise in remote medical capabilities, especially relevant to medical countermeasures.

Australian businesses can also take advantage of the significant market opportunities that exist within the international supply chains of the prime contractors. Successful Australian businesses who have contributed to Australian Defence acquisitions have become an integral part of the responsible prime's supply chain and continued to sell their products to large international projects. [21]

Supporting Australian defence exporters

Australian defence exports are defined as any defence-specific or dual-use goods or services that are intended for a defence or national security end-user in a foreign country.

The Australian Government has set a strategic goal to increase defence exports which are currently valued at approximately $1.5–2.5 billion per year. [22] The *Defence Export Strategy* brings together all of the levers available to governments, Defence and industry to provide end-to-end support for defence exporters, from building export readiness, to identifying export opportunities, and ultimately realising export outcomes. While the pursuit of defence exports is a joint endeavour between industry and governments, defence exports themselves are driven by commercial considerations of industry.

The Australian Defence Export Office-established as a key initiative of the Defence Export Strategy, leads whole-of-government efforts to support Defence industry to export.

Beyond income from direct exports, overseas investment particularly from key global companies including primes, continue to help the Australian defence industry to grow in size and capability, as well as providing new supply chain opportunities.

Austrade is the lead Australian Government agency for investment attraction, and in the 2019-20 financial year, Austrade facilitated 23 foreign direct investment outcomes across defence, advanced manufacturing and space, $23 million of which were announced. These include new industrial capabilities, partnerships with existing Australian companies, and investments in R&D. In the 2019-20 financial year, Austrade helped over 300 defence, advanced manufacturing and space exporters through business advice, general assistance, and support in country. [23]

21 Defence Connect: Global Supply Chain Program success for Aussie SME, 2019, accessed 1 March 2021.
22 Department of Defence, Defence Export Strategy, 2018, p. 33.
23 Support in country means identifying partners for Australian businesses, identifying customers, providing support for in-country visits and helping establish an overseas presence.

Global opportunities

Current priority and export opportunity markets for Australian defence manufacturers include close like-minded partners, and emerging markets across the Indo-Pacific region.

Canada, New Zealand, the United Kingdom (UK) and the US represent Australia's highest defence export market priority, due to Australia's close relationship with those countries and their ability to strengthen Australia's export market.

Australia is also strategically positioned to export to key regional partners, notably Japan and the Republic of Korea. South East Asian countries are rapidly developing, presenting opportunities for Australian defence manufacturers to export defence products as well as participate in sustainment projects.

Involvement in global programs such as the F-35 Cooperative Partnership provide opportunities for Australian defence manufacturers to build a strong sovereign manufacturing capability. To date, more than 50 Australian companies have shared in over $2.7 billion in F-35 production and support contracts. In fact, there are Australian-produced parts on every F-35 in operation around the world. This is an important part of the Australian Government's commitment to building a robust Australian defence industry capability, and efforts continue as the F-35 Program transitions into the sustainment phase.

Case in point, BAE Systems Australia (BAESA) selection as the F-35 Air Vehicle depot for the South Asia-Pacific region not only means that BAESA will conduct maintenance, repair, and overhaul on Royal Australian Air Force F-35A aircraft in Australia; it also positions the company to potentially host aircraft from other nations in the future. BAESA has also been selected to host the F-35 Asia-Pacific Regional Warehouse, which is planned to store and manage parts for the international F-35 fleet as part of the Global Support Solution.

Europe's defence market is a priority market for Australian exporters as well. However, the Defence Export Strategy notes that it is a challenging market for Australian businesses, with high barriers to entry and significant domestic competition.

Examples of international market opportunities for manufacturers

Expanding capabilities to service existing and new export markets with strategic partners including:

- **production of energetic materiel**: Developing and manufacturing energetic materiel, including high explosives, propellants and primers, using current technologies and future alternatives.
- **load, assemble and pack capability**: The ability to fill and load, assemble and pack designated explosive ordnance products inclusive of handling high explosive fill and use of advanced / lightweight components and parts.
- **sustainment of advanced radar systems**: Skills, equipment and facilities necessary to maintain and provide ongoing assurance of leading radar systems.
- **active and passive radar design and production**: Researching, designing, assembling, integrating and upgrading advanced radar technologies that offer scalable and capable radars for use in the maritime, land and air environments.
- **execution of maintenance, repair and overhaul activities**: The application of fleet management techniques and supply chain optimisation to maximise operational aircraft availability and the ability to perform entire platform deeper maintenance cycles. This includes:
  - platform maintenance, repair, overhaul and upgrade in a timely and cost-effective manner
  - deeper maintenance of elements below the platform level, such as engine and propulsion systems, major mechanical and hydraulic components, avionics, and mission system components
  - advanced surface coating and finishes at the platform and component level.
- **aerospace platform structural integrity**: The ability to perform engineering analysis and testing of structures to inform the effective management of aerospace platforms ensuring they are operational, safe and fit for purpose throughout their service life. Specific areas of focus include:
  - airframe and propulsion system life certification
  - fatigue testing and analysis
  - non-destructive testing for composite and advanced material repairs
  - developing non-standard repairs for metallic and advanced composite structures
  - designing, developing and repairing parts through additive manufacturing processes.
- **naval shipbuilding and design**: Developing and manufacturing shipping components and products.

Opportunity: Cross-sector applications

The defence industry sector has traditionally played a pivotal role in facilitating the development and commercialisation of advanced technologies with cross-sector applications. The sector has also provided a platform for manufacturers to develop global connections in industries like aerospace and automotive. Shared capability requirements, such as remote operation, automation, robotics and specialised steel manufacturing; and cross-pollination of ideas and innovations lead to strong connections with other industry sectors and technologies including:

- Artificial Intelligence (AI)
- Mining Equipment, Technology and Services (METS)
- Space
- Advanced manufacturing.

These linkages also provide an avenue for further commercialisation of advanced technologies. Perhaps the best-known products of defence R&D—the Global Positioning System (GPS) and the black box flight recorder—are now in world-wide civilian use.

However the technology exchange goes both ways, from military to civilian, and civilian into military applications. For example virtual reality (VR) technology typically associated with gaming is now diversifying into the military sector. VR has the potential to simulate a range of environments and provide new ways of training, from language and cultural training, to peacekeeping and joint operations. [24] More examples of cross-sector applications are in Figure 6.

Adjacent sectors and activities with potential to supply defence (including both components and finished products), and where Australia has competitive advantages or existing strengths, include:

- resources or mining technologies
- medical products and healthcare
- shipbuilding
- space capabilities
- telecommunications
- land vehicles
- unmanned systems in maritime and aerospace, including surveillance aircrafts and underwater vehicles.

24 Defence Connect, Video games and warfighting: The curious link, 8 June 2020, accessed 24 February 2021.

Figure 6: Examples of technology exchange and diversification opportunities for the defence industry [25]

Space

Investments in space capabilities were significantly strengthened in the 2020 Force Structure Plan, providing new opportunities for the emerging space manufacturing sector.

Resources Technology & Critical Minerals Processing

Technology exchange between resources and Defence has a long tradition. Spin-offs from DST Group work on sonar sensors to detect activity at sea created products for the civilian seismic industry.

Medical Products

Medical and Defence manufacturers are working to commercialise nutraceuticals and countermeasures (e.g. the DMTC diagnostic tool to rapidly test for infectious diseases in remote areas).

Clean Energy

Power systems (e.g. batteries and fuels) to increase efficiency and power assets are a Defence focus. E.g. battery technology developed for mining vehicles is now applied to military vehicles.

25 Department of Defence, 2020 Defence Strategic Update, p. 38-39; Innovation and Science Australia, Australia 2030: prosperity through innovation, 2017, p. 67; DMTC Annual Report 2020, p. 26; @AuManufacturing: 3ME battery technology headed for battlefield, September 17, 2020, accessed 1 March 2021.

Examples of cross-sector applications market opportunities

Diversifying defence manufacturing to cross-sector applications (spin-offs), or applying non-defence civil technologies to Defence (spin-ins) with products such as:

- **space domain awareness**: Designing, developing, and sustaining integrated sensor networks for persistent surveillance of space objects and phenomena that can be certified and operated as part of a global network shared with our international partners.
- **space-based surveillance technologies**: Designing, developing, and sustaining integrated orbital sensor networks for Earth observation, that can be certified and operated as part of a global network shared with our international partners.
- **space-enabled Earth observation technologies**: To support more efficient emergency response systems and weather monitoring (for example, GPS and satellite systems to monitor weather and climate, detect environmental disasters, and assist in crop management, urban or environmental planning).
- **medical countermeasures**: Developed for protection of military and civilian personnel against Chemical, Biological and Radiological (CBR) threats, emerging infectious diseases and pandemics and include diagnostic tools, personal protective equipment and treatment for infectious diseases and radiological threats.
- **C4I integration**: Integrate tactical sensor and persistent surveillance technologies operating at multiple security levels into ADF and Five Eyes command, control, communications, computing, and intelligence (C4I) systems.
- **unmanned aerial/maritime vehicles**: Trusted autonomous systems to enable increased situational awareness, surveillance and enhanced decision making in complex environments.
- **advanced remote monitoring systems/mobile robotics** with a capacity to be applied in defence.

5. Enablers

Key enablers for building the capability of defence manufacturers include intellectual property and advanced technologies.

Intellectual property (IP)

Creation, ownership and access to IP are critical enablers to developing Australian domestic Defence capability and viable export capability. Pursuing more home-grown innovation and Australian-owned IP in defence capabilities allows Australian defence manufacturers to move beyond integration, assembly and support activities for the ADF to high value manufacturing of unique exportable products.

Industry 4.0 and advanced technologies

Manufacturing innovation is closely linked to the concept of Industry 4.0 and the modernisation of business models, processes and products. Broader industry consultations conducted in developing this road map identified that adoption of Industry 4.0 and advanced manufacturing in defence logistics, distribution and production operations could deliver significant benefits in terms of building agility and tailored customer-centric products.

Internationally, countries are already embedding emerging technologies into warfare systems and equipment to improve their performance and reduce maintenance costs. Some examples include image recognition to enhance search tasks and natural language processing applications to assist military planners with Requests for Information.

Many planned Defence capability investments include those that require Industry 4.0 technologies, such as remotely piloted or autonomous systems, and innovations that apply machine learning, cloud adoption, and rapid manufacture to Defence priorities.

The rapid push to remote and digital solutions during the COVID-19 crisis has highlighted an opportunity for the defence industry to streamline operations. [26] Continued implementation of these technologies and growth in digital maturity can further enable businesses to win Defence contracts and over time scale-up, while managing the complexity of the sector.

Defence manufacturers require higher levels of security systems to protect their operations from threats. In particular, the industry has a higher risk of cyber attacks due to the sensitivity of their projects and operations.

Transformative technologies such as robotics, sensors, big data analytics and artificial intelligence provide the opportunity for defence manufacturers to upgrade their operations and protect themselves against cyber attacks.

The widespread benefits of adopting transformative technologies like Industry 4.0 technologies into manufacturing business operations include:

- Better connectivity between customers and supply chains through real-time access to production information, logistics and monitoring.
- Greater flexibility for businesses to produce differentiated products and services to tap unmet consumer demands, compete in global markets and capture emerging opportunities.
- Improved quality management and production, for example by using a digital twin (a digital model of a physical product, process or system) to help optimise performance. [27]
- Improved sustainment outcomes through large scale data collection on equipment performance, including the ability to predict and prevent operational issues.
- Enhanced workplace safety, production and improvements across the entire value chain. [28]

While adoption of these technologies provides significant benefits to all businesses, it is particularly beneficial for medium-sized businesses that can leverage these productivity gains into furthering additional leading-edge research and defence capabilities.

26 Australian Defence Magazine, How Covid-19 re-shaped defence industry, 28 September 2020, accessed 24 February 2021.
27 Sage Automation, Bringing Industry 4.0 technologies to the Australian Defence Industry, 1 August 2019, accessed 11 February 2021.
28 Department of Industry, Science, Energy and Resources, Industry 4.0, 8 December 2020, accessed 22 December 2020.

6. Goals

Over the 2, 5 and 10 year life of the road map, Government will partner with and support industry to build the Australian defence manufacturing sector to leverage investments in national Defence priorities, and scale manufacturers to capture export opportunities in the defence industry and beyond.

An Australian defence manufacturing base that delivers **world-leading capabilities** for the Australian Defence Force (ADF) and is **internationally competitive**.

This stronger manufacturing base will be enabled by a larger number of medium-sized defence businesses that can secure long-term supplier relationships, contribute to and sustain Defence capability, and engage with small businesses.

Success at 2 years – by end of 2022

Opportunity: Defence

1. Commercialisation opportunities are unlocked through co-investments by governments and industry in projects that contribute to or align with ADF required capabilities.
2. Industry investment in technologies/ business capabilities allow them to contribute to Defence priority capabilities.
3. There is increased collaboration between primes and other businesses in Australia, increasing the number of firms engaging with local defence supply chains.

Opportunity: International

8. Increase in investment in projects, facilities and manufacturing products that are able to be used by the ADF and other like-minded countries.

Success at 5 years – by end of 2025

Opportunity: Defence

4. Australian defence manufacturers have an increased ability to meet demands set out by the Government through partnering together on large projects.
5. Small manufacturers have begun to scale through participation in defence supply chains and there are more medium and large-sized businesses active in the Australian defence industry.

Opportunity: International

9. Australian defence manufacturers are making more globally competitive products and are exporting products to like-minded partners.

Success at 10 years – by end of 2030

Opportunity: Defence

6. Australian defence manufacturers contribute more to ADF capabilities, directly or through primes' supply chains. There is an increase of Australian IP in products utilised by Defence.
7. Australia has a number of successful medium and large-sized defence manufacturers conducting high-value activities onshore.

Opportunity: International

10. Australian manufacturers are more globally competitive as a result of improved capabilities, the expansion of the defence market and an increase in commercialisation activities.
11. There is a greater number of medium-sized manufacturers that are locally and globally competitive.

Success at 2 years – by end of 2022	Success at 5 years – by end of 2025	Success at 10 years – by end of 2030
Opportunity: Cross-sector applications	**Opportunity: Cross-sector applications**	**Opportunity: Cross-sector applications**
12. Investments in building or commissioning facilities that can be shared such as secure laboratories, joint equipment and testing facilities. 13. Increase in investment in the manufacturing of products that are applicable in civilian sectors such as space and mining.	14. Australian defence manufacturers are entering new markets with products that have cross-sector applications. 15. Greater local manufacturing ability of critical Defence capabilities. 16. Industry has better experience and resources, including shared facilities, to continue to commercialise innovations.	17. Australian defence manufacturers have diversified their customer base and entered new markets and sectors that support their ongoing ability to meet the demands of the ADF as required.

7. Making it happen

Leveraging growth opportunities through partnerships between Government and industry, the defence manufacturing sector will be able to scale-up their operations and be more competitive. To achieve the overarching vision for the sector, actions include building up the ability of defence manufacturers to supply the ADF, specific support for manufacturers to expand into export markets and assistance to diversify into markets outside of defence. The road map also outlines broader policy actions and key enablers of advanced manufacturing that may be required for participation in some defence projects.

Implementation of these actions is expected to help defence manufacturers overcome some of the fundamental barriers to scaling, namely:

- the difficulties in breaking into defence supply chains (directly or via primes)
- creating and converting innovations into successful commercial products
- diversifying their customer or market base to counter the cyclical nature of defence procurement
- accessing or complying with the specialised infrastructure or standards required to operate in the defence industry.

The co-investments referred to in this road map will be enabled primarily by the Government's funding available through the MMI and are supported by the existing Defence and Industry portfolio initiatives, ranging from advice and facilitation services to innovation grants. This road map also outlines future policy work for all levels of governments to further help Australian businesses to join the growing defence industry.

Actions to capture the Defence opportunity

Defence has established capability priorities that provide unique market opportunities for Australian manufacturers and can drive productivity, skills and innovation. Targeting investments and activities towards these priorities is likely to help manufacturers grow their own capability and capacity.

Actions

Co-investment by Government and industry in production or deployment of prototypes, in undertaking late stage R&D or in commercialisation activities.

These activities should link to or develop capabilities aligned to the current or emerging Defence priority capabilities.

The activities can be undertaken by an individual business, a group of businesses, or a consortium.

- Current priority capabilities include those listed in the Sovereign Industrial Capability Priorities (SICPs) and the 2020 Force Structure Plan. Priorities are reviewed periodically.

Investment should focus on:

- Supporting activities that would not otherwise happen without co-investment by governments and industry.
- Bringing consortia of businesses together to deliver large and significant benefits to Defence.
- Bringing parts of supply chains back to Australia ('on-shoring') where domestic manufacturers have the capability to meet ADF requirements or serve civilian sectors, where this is economically viable.
- Increasing the proportion of Australian industry ownership of the associated IP which can enable more exports or sustainment activities. Co-investors (governments and industry) need to outline an appropriate strategy for how the IP would be managed.
- Ensuring knowledge sharing and transfer between primes and small and medium Australian defence manufacturers without breaching commercial and IP arrangements.

Co-investment by Government and industry in facilities that help participants share resources to develop the necessary technologies, processes and practices to compete for contracts and contribute to current Defence priority capabilities.

- Facilities could include secure operation facilities, testing facilities or joint equipment.
- They also can be facilities that provide access to business networks or encourage collaboration in other ways—particularly activities that can help small businesses to connect with primes.
- They could also include investment in shared high performance computing capabilities and associated data sets required for deep learning applications.
- Collaboration could also aim to produce or develop related IP and build up defence manufacturers' abilities.

In addition, all levels of governments can assist small businesses, in particular, to build the required capabilities for entering Defence markets and navigating the defence industrial operational environment through:

- Creating a database of capabilities within Australian manufacturing that are relevant to Defence priorities, and identify gaps where there are future business opportunities which investment could target (co-led by the Industry Portfolio and industry).
- Assistance to implement quality management systems.
- Assistance to attain and retain certifications and accreditations.
- Assistance to have Australian certifications and accreditations recognised as equal to the international standard where appropriate.
- Building on existing linkage initiatives such as prime roadshows and networking events, identify other mechanisms to increase engagement between businesses and primes.
- Building on existing initiatives, identify mechanisms to increase the business community's awareness of Defence procurement opportunities.
- Enhancing awareness of Government initiatives or opportunities that can improve defence manufacturers' business management abilities, support business growth (for example Manufacturing Modernisation Fund and the MMI, and Defence related procurement), and support to overcome the hurdles for entering defence supply chains.
- Providing greater awareness of, and accessible information on Defence opportunities to SMEs, and identifying opportunities along the defence supply chain to promote their development.
- Leveraging the ongoing work within the Defence portfolio, work towards improving the identification and classification of defence industry, including manufacturing, and estimating its economic contribution to enable effective impact evaluation of the road map.

Actions to capture the International opportunity

International collaborations and exports by Australian defence manufacturers can provide a source of continuous work and funding for product development or commercialisation. Participation in international markets could generate contacts with possible business partners and product end users that could lead to new market and export opportunities.

The Defence Export Strategy has identified that the majority of Australian defence exports are already relatively high value: technologies, components and specialised products produced by SMEs. This highlights an opportunity for Australian primes to use their position to target more systems- level export opportunities in the future, thus increasing export volume. [29]

Actions

Co-investment by Government and industry to demonstrate or commercialise products that have a potential for export, in foreign defence forces and/or broader national security sector (acquisition or sustainment), or civilian markets.

Co-investment by Government and industry to undertake late stage research collaborations or commercialisation with international partners. The projects should relate to validation or viability of later stage commercialisation.

Investments should focus on:

- Collaborating to develop new technologies and capabilities relevant to Australian (or overseas) defence priority capabilities.
- Creating greater linkages between foreign businesses, including primes and Australian industry, particularly SMEs.
- Increasing the proportion of Australian ownership of the associated IP in the exports when this aligns with the Export Controls and other regulations.

Actions to capture the Cross-sector opportunity

The defence sector is playing a pivotal role in facilitating the development and commercialisation of advanced technologies with cross-sector applications. The defence sector also benefits from capabilities such as the critical minerals sectors processing of oxides, metal alloys, precursor chemicals and battery components into production inputs.

There is significant scope for defence manufacturing to 'spin-in', or 'spin-off' to adjacent sectors and activities.

Actions

Co-investment by Government and industry to demonstrate or commercialise products or services that have a potential for:

- Adapting non-defence technologies to contribute to defence priority capabilities.
- Adapting defence innovations to applications in civilian sectors such as space, healthcare or mining.

The investments should support prototype demonstrations in an operational environment. Projects can be led by a single business, a group of businesses, or a consortium.

To continue to build industry's ability to diversify their business offerings and exports, the taskforce identified additional opportunities that can further assist Australian manufacturers:

- Building on the work of Austrade, identifying further mechanisms to make it easier to find information on exporting and examples of successful defence exporters.
- Increasing the awareness of initiatives that educate and train business owners to successfully promote their products and services to overseas markets.
- Identifying opportunities for cross-sector collaboration that allow manufacturers to improve their commercialisation and procurement prospects, for example between defence and space.

29 Examples of such platform and system level capabilities that are exported include: Thales Australian military vehicles and Australia's defence vessels. Department of Defence, Defence Export Strategy, 2018, p.36.

Actions to unlock Enablers for growth

Embracing the digital transformation of manufacturing, referred to as Industry 4.0, is becoming crucial for scaling-up and competing internationally for all manufacturers. [30] The Government can assist with the digital transformation by co-investments with industry in technologies, as capital costs can be a barrier for many businesses.

Actions

Co-investment by Government and industry to support defence manufacturers acquire and adopt new technologies and/or purchase IP.

- The co-investments need to directly assist the business commercialise a product that either contributes to a priority Defence capability or where there is a potential cross-sector or export market.
- The co-investment should be accompanied by a clear strategy for adopting new technologies into business operations.

The taskforce identified the following policy actions to support businesses to build the required digital capabilities to operate in Defence supply chains:

- Strengthen cyber security awareness and capabilities in the defence manufacturing ecosystem. The Government has numerous initiatives that can be leveraged in order to improve cyber security, such as:
  - The broader Government vision for advancing and protecting our national interests online, outlined in *Australia's Cyber Security Strategy 2020*. This will include applying the recommendations and actioning priorities identified in the AustCyber Sector Competitiveness Plan.
  - The Cyber Security Partnership Innovation Fund, which provides industry with funding to deliver innovative projects that meet local requirements to quickly improve the quality or availability of cyber security professionals in Australia. [31]
- Assistance for businesses to access Defence security training through the Defence Industry Security Program membership.

30 Advanced Manufacturing Growth Centre, Industry 4.0: An opportunity for every Australian Manufacturer, March 2018.

31 Business.gov.au, Cyber-security skills partnership innovation fund, 4 February 2021, accessed 18 February 2021.

8. Benchmarks of success

The road map focuses on creating transformative change in the defence manufacturing sector to growth in higher value-add activities. It is expected that participants in the MMS will grow jobs, exports and profits and expand Australia's defence manufacturing capabilities.

To measure our progress against the vision set out in the road map, the following may be monitored over 2, 5 and 10 year periods, dependent on data availability:

- number of new jobs
- increase in profitability
- growth in defence manufacturing exports
- increase in the number of new products brought to market
- growth of medium sized businesses in defence manufacturing
- investment in the defence manufacturing sector.

This road map aims to take Australia into new and different defence manufacturing activities to deliver economy-wide benefits. Importantly, the Government is working to establish a data-informed baseline for the size and economic contribution of the defence industry sector, including manufacturing. New and innovative approaches to capture pre and post production activities are under development and may be used to identify and capture this activity in future.

9. Engagement and partnerships

For defence manufacturers, domestic and international partnerships with other businesses and research organisations are essential for successful operation within the broader defence industry. Ongoing and increased collaboration with research institutions will enable defence manufacturers to leverage Australia's world-class research base and commercialise Australian ideas.

Continued investment in innovation and collaborative practices in the areas of R&D, late stage commercialisation and other related innovative activities will be critical. This investment helps defence manufacturers achieve the technical or operational standards required to supply defence markets, scale their operations, and increase the resilience of supply chains.

International Partnerships

Globally, Australia is seen as a trusted export and trading partner. Australia's bilateral collaborations with countries such as the US and the UK have enabled us to play a significant role in the delivery of capabilities such as the electronic warfare suite on the EA-18G Growler aircraft and the Nulka active missile decoy.

The 2017 US National Defense Authorisation Act expanded the definition of the US National Technology and Industrial Base (NTIB) to include Australia and the UK, in addition to Canada. Defence continues to work with the US to address defence trade issues and industrial barriers to leverage our inclusion in the US NTIB. It is critical that our defence industries work closer together, and Australia's inclusion provides an opportunity for us to collaborate on emerging technologies with the US and other close partners.

There are also numerous collaborative projects which provide Australia's defence manufacturing sector with access to global opportunities and support diversification.

F-35 Joint Strike Fighter Program

Australia is acquiring the F-35A aircraft as part of the Joint Strike Fighter Program, an international co-operative program led by the US. Along with other international partners, Australia contributes to the management and development of the F-35 air system. Under the co-operative agreement, international partners bid for and win work on the global program on a best-value basis.

The F-35 Program is helping to further build the capability of Australian industry as it contributes to the global production of F-35 capability. To date, Australian industry has won over $2.7 billion of work with more than 50 companies involved, with many more indirectly benefitting through supply chain work. Additionally, Australia is becoming a regional support hub after being selected as the maintenance, repair, overhaul and upgrade depot for the Southeast Asia region.

The program is also creating opportunities for companies which originally supplied to the F-35 program and are now breaking into adjacent sectors, leveraging their expertise in manufacturing extremely high-end products and systems.

Global Supply Chain Program

The Global Supply Chain (GSC) Program helps Australian businesses find opportunities in the international supply chains of multinational defence companies. Since 2007 the participating prime companies have awarded over $1 billion of work to Australian businesses, most of them SMEs. Bid opportunities are weighed against other overseas bids, requiring the Australian business to be globally competitive.

Through the GSC program, primes are required to establish a GSC team within their company. In addition to providing bid opportunities, the GSC primes advocate on behalf of Australian industry, train and mentor companies in the primes purchasing practices and methods, and provide market assistance including facilitating visits and meetings with key decision makers.

Domestic partnerships

Partnerships present an avenue for local defence manufacturers to enter defence supply chains and increase their capability to supply the ADF. Due to the large scale and complex nature of defence projects, numerous manufacturers may be required to supply different components of a project. These partnerships are likely to encourage increased innovative activities due to higher levels of collaboration, which could result in greater levels of IP development and open new markets for goods and services. They also provide opportunities for Australian firms to account for a larger share of manufacturing activities, for example, manufacturing component parts.

Bushmaster Protected Mobility Vehicle

The Bushmaster is a locally produced protected vehicle from the Thales Group built in Bendigo, Victoria. It has so far been successfully deployed by 3 armies on operations and is in service with 6 countries. [32]

The delivery of this capability has provided opportunities for Australian firms to partner with primes and other businesses and to manufacture and supply sophisticated components to support the project. For example, more than 80% of the parts of the vehicle's remote weapons stations are sourced through the Australian supply chain. [33]

Collaboration

To realise the benefits of innovation and deliver the Australian Defence capability priorities, research organisations, defence industry and all levels of governments must collaborate in order to translate good ideas into commercial outcomes. This includes creating connections between research and businesses, facilitating collaborative activities through partnerships, and attracting investment for R&D. Collaboration is essential in Defence—it is not possible for an individual business or research group to develop, test and provide every component of a complex military capability.

Collaboration also strengthens supply chains by providing access for small and medium companies to contribute to large projects, creating opportunities for innovation and to scale-up their businesses. In the Defence context, business to business collaboration is the key for Australian SMEs to establish linkages with primes, integrate in their supply chains and contribute to the delivery of large capabilities. Knowledge transfer through collaboration also increases the likelihood of a business taking ownership of IP for their products or processes, which is critical to developing a sovereign defence industrial base and accessing longer term sustainment opportunities.

With the majority of large scale Defence capabilities delivered through primes, there are many examples of successful collaborations driven by industry.

Boeing Loyal Wingman Drone Development Program

The unmanned Loyal Wingman is the first aircraft to be designed, engineered and manufactured in Australia in over 50 years. The Government is investing up to a total of $155 million in its development, alongside Boeing's largest investment in a new unmanned aircraft. The investment will support the project's workforce and key industries, including high technology aircraft manufacturing and flight testing. There are more than 35 Australian businesses on the project's Australian industry team who are closely collaborating to progress the project. [34] The first Loyal Wingman completed its first flight on 2 March 2021.

R&D collaborations

Defence, in conjunction with the defence industry, has a number of initiatives that are aimed at supporting collaboration and partnerships in the sector, including:

- **DST Group** Partnerships with both large and small defence companies including as well as universities and CSIRO to conduct R&D, including for example with:
  - Airbus Group on defence aircraft systems and communications
  - ASC on Collins Class submarine-related technologies
  - BAE Systems on cyber security and electronic warfare.
- **Next Generation Technologies Fund** managed by DST Group identifies priorities for focused R&D over the next decade including quantum technologies, trusted autonomous systems and advanced sensors, hypersonics and directed energy capabilities. [35]
- **Defence Innovation Hub** funds the development of innovative technologies that have the potential to deliver Defence a capability edge while supporting local industry. International experience demonstrates that hubs and clusters provide the foundations for increased levels of innovation and R&D, exports, and new jobs; while signalling globally that a country is making long-term investments in its innovation ecosystem. To date, the Defence Innovation Hub has invested over $306m in contracts with over 96 Australian businesses and 13 universities and research institutions.

32 Thales Group, Bushmaster, accessed 11 March 2021.
33 Prime Minister of Australia, New Weapons Boost Army Capability and Secure Jobs, July 2020, accessed 11 March 2021.
34 Boeing, Loyal Wingman Australian industry team, accessed 20 January 2021.
35 Department of Defence, Next Generation Technologies Fund, accessed 24 February 2021.

Appendix A

The road map development process

On 1 October 2020, the Australian Government announced $1.5 billion to be invested over the next 4 years in the Modern Manufacturing Strategy (MMS) to help Australian manufacturers become more competitive, resilient and build scale in the global market.

The centrepiece of the MMS is the $1.3 billion Modern Manufacturing Initiative (MMI) which will allow Government to invest in projects within 6 National Manufacturing Priority areas. The 6 National Manufacturing Priority areas are:

Resources Technology & Critical Minerals Processing

Food & Beverage

Medical Products

Recycling & Clean Energy

Defence

Space

Road maps have been developed with industry to set out plans for both industry and Government to strengthen Australia's manufacturing capability. The road maps have been led by 6 industry taskforces to identify and set a future vision for the priority areas with clear goals, opportunities and actions over the next 2, 5 and 10 years.

Members of the industry taskforces were selected based on their expertise across the priority areas, and were supported by technical experts from the CSIRO, the Department of Defence, the Department of Industry, Science, Energy and Resources (the department) and Industry Innovation and Science Australia.

Taskforce deliberations focused on current and future issues, challenges and opportunities to identify actions businesses and governments can undertake to support scale, competitiveness and resilience in defence manufacturing in the next 10 years.

Government has also been working with industry beyond the taskforce to understand the manufacturing needs of the defence sector. A public consultation process was held between 23 October 2020 and 9 November 2020 which received 340 responses, including 38 focused on defence manufacturing.

Inputs on the key strengths, opportunities and solutions to grow manufacturing have been used to inform the road map. The road map was also informed by bilateral meetings with key stakeholders as well as research conducted by the department.

Defence industry policy settings

The foundational Australian Defence policies that shape the domestic industry are listed below.

The 2020 Defence Strategic Update sets out the challenges in Australia's strategic environment and their implications for Defence planning. It reaffirms the Government's commitment to developing a strong, sustainable and secure Australian Defence industry and supporting leading edge national innovation.

The 2020 Force Structure Plan outlines the planned investment in Defence's capability requirements, including in relation to the following emerging technologies:

- adopting remotely piloted or autonomous systems for a range of missions, such as air combat, strike, air-to-air refuelling, surveillance, undersea warfare, and land operations
- capabilities to counter emerging space threats and ensure space access
- high-speed missile systems to provide more deterrence options
- directed energy weapons for close-range defence of naval vessels, and for the land forces to defeat armoured vehicles.

The 2018 Defence Industrial Capability Plan sets out Government's comprehensive plan for Australia's defence industry. The plan includes the Sovereign Industrial Capability Assessment Framework and introduces Defence's initial Sovereign Industrial Capability Priorities (SICPs), comprising:

- Collins Class submarine maintenance and technology upgrade
- Continuous shipbuilding program, including rolling submarine acquisition
- Land combat and protected vehicles and technology upgrade
- Enhanced active phased array and passive radar capability
- Combat clothing survivability and signature reduction technologies
- Advanced signal processing
- Surveillance and intelligence
- Test, evaluation, certification and systems assurance
- Munitions and small arms research, design, development and manufacture
- Aerospace platform deeper maintenance and structural integrity.

The 2016 Defence Industry Policy Statement strengthens the partnership between Defence and industry through a focus on stronger, more strategic partnerships and closer alignment between industry investment and Defence capability needs. The Statement also seeks to enhance collaboration between Defence and industry in establishing the Centre for Defence Industry Capability, Defence Innovation Hub and Next Generation Technologies Fund.

The Defence Industry Skilling and STEM Strategy outlines a plan for building a technology-enabled Australian Defence Force and defence industry workforce. The Government has committed $32 million between 2019 and 2022 to ensure the Strategy is responsive to industry needs.

The Defence Export Strategy sets out programs and initiatives aimed at delivering greater export success to build a stronger, more sustainable and more globally competitive Australian defence industry. It provides $20 million in funding to support Australia's defence exports and established the Australian Defence Export Office to provide a focal point for defence exports and drive implementation through to 2028.

Building on other policies and strategies

Recognising the valuable work already completed in this area, development of the road map also drew upon relevant strategies and existing Government initiatives including but not limited to:

- Small Business Innovation Research for Defence: The program is managed through the Next Generation Technologies Fund and seeks to encourage a new generation of innovators in developing breakthrough technologies for the ADF.
- COVID-19 Recovery Investment Package: $1 billion investment package to boost Australia's defence industry. The investment package is linked to defence manufacturing as it includes a focus on sustainment of ADF platforms and capabilities, funding for defence innovation as well as targeting key manufacturing sectors within defence.
- Australia's Cyber Security Strategy: The Australian Cyber Security Strategy 2020 will invest $1.67 billion over 10 years to create a more secure online world for Australians and Australian businesses.
- Skilling Australia's Defence Industry Grants (SADI) Program: SADI provide businesses servicing the defence sector with upskilling and training opportunities to meet current or future Defence needs.
- 2019-2030 Moving Towards a High-Tech Future for Defence, Workforce Strategic Vision underpinned by Stem: The STEM Strategy outlines the vision for Defence to build a technology enabled Australian Defence Force and Defence industry workforce.
- Australian Industry Capability Program: The Australian Industry Capability Program requires that prime companies competing for Defence contracts demonstrate how they will maximise opportunities for Australian industry involvement. The Government is committed to maximising opportunities for Australian industry to participate in Defence projects, including in regional areas. This program will contribute to the development and sustainment of the enduring industrial capability required to meet Defence's strategic needs.
- The Defence Global Competitiveness Grants Program: Grants to help Australian businesses invest in projects that build their defence export capability.
- More, together. Defence Science and Technology Strategy 2030: The strategy focuses on 3 strategic pillars:
  - One Defence science and technology capability
  - Brilliant people, collaborative culture
  - Outstanding research infrastructure powering innovations.

Appendix B

Barriers to Scale

This road map seeks to support the Defence National Manufacturing Priority area to achieve its full potential by overcoming barriers to scale. The defence manufacturing taskforce sees the Government's work to get the economic conditions right for all manufacturers as an important opportunity to improve competitiveness, particularly in:

- **Skills and workforce**: the sector is knowledge driven, so relies on having access to the STEM and vocational skills needed to commercialise emerging technologies, and advanced manufacturing capabilities. Industry stakeholders noted that some of the skills critical to Defence are in short supply within the broader economy and businesses can find it difficult to attract candidates and fill vacancies.
- **Regulation and standards**: the defence industry is a heavily regulated environment. Regulations and standards include the workforce and facilities being used having the appropriate security clearance, export controls and in some cases international accreditations. Improving the ability of businesses to navigate regulation effectively and efficiently is a key enabler of competitiveness for new businesses and products to enter the market.
- **Energy**: affordable energy and energy technology is critical for manufacturers, particularly when they play an important role in supporting critical Defence capabilities.

The key barriers to scale and competitiveness in the defence manufacturing sector identified during the road map development process include:

- **Commercialisation**: Bridging the gap between early stage technology and commercialisation can be challenging. Further, the sector is predominantly small firms that may not have the necessary resources to invest in commercialising their ideas.

  Current R&D initiatives are predominantly received in lag support, meaning businesses receive the funding after they have already invested in R&D. Commercialising specialised defence products and technologies is also resource intensive and a lengthy process with limited guarantee of procurement at the end.
- **Procurement**: Business continuity has been a challenge for the Defence industry. Defence procurement can be cyclical, as the demands set out by the ADF may not be enough to sustain business for long term. To overcome this challenge, defence manufacturers must either diversify their products to adjacent industries or exports.
- **Exports**: Breaking into exports is a challenge for Australian businesses, especially for those who have not provided services or products to the ADF before—overseas buyers often only want to acquire products that have been tested. Many countries support their own industries via offset requirements, hindering access and complicating exports. Exports of sensitive technology are subject to a greater level of scrutiny by Defence Export Controls due to an increasingly complex strategic environment and the need to protect the ADF's capability edge and sensitive technologies from exploitation and misuse.
- **Standards and Compliance**: The products for Defence need to be extremely high quality (no fail), and often require adherence to specific international standards which are hard, especially for small businesses, to implement. Due to the above, Defence procurements tends to be more geared towards well-established contractors, most often Defence primes. This approach presents a barrier for new participants to get access to defence supply chains.

  There is an increasing requirement for Australian businesses to not only be accredited to Australian standards, but they must also hold international accreditations (seemingly dependent on the country of origin of the defence prime). High security requirements for Defence projects can include physical security of people, information and assets. Businesses need to identify their security risks and the right security strategies to manage these risks if they are seeking to partner with Defence or primes.
- **Digital Technologies**: Manufacturers often do not have the resources and experience to adopt digital or Industry 4.0 technologies that will enable them to scale their operations or otherwise better meet the demands for defence products. Cyber security is a priority issue for businesses in the defence supply chain, with an increased risk of cyber attacks due to the sensitivity of their projects. Similarly to Industry 4.0, many businesses do not have the resources to understand cyber risk or develop and implement appropriate security measures.