

Security and Defence in Western Australia: An Economic Perspective



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Acknowledgements:

Regional Development Australia and Risk Intelligence Solutions would like to thank all those stakeholders including the Australian Government, the Western Australian Government, Economic Development Australia and all the Local Governments in the Perth and Peel region as well as the regional development organisations and individuals who have contributed to this important study along with the members of the international Expert Panel Kenny McDonald and Niel McInroy.

In addition, Regional Development Australia and Risk Intelligence Solutions wishes to acknowledge the kind and considerate advice and support rendered by the following individuals, who in various capacities assisted in shaping the outcome of this study. They include Professor Peter Leahy AC, Dr Stephanie Koorey, Stephen Bunce, Simon Louie, Jose Sousa Santos, Greg Salotti, Commodore Brett Dowsing, Pat Hall, Brett Biddington, Derek Parkes, James McMahon, Peter Horobin, Jonathan Smith, Peter Lockwood, Professor Stephen Smith, David Johnston, Peter Kershaw, Denton Bocking, David Trench, Stephen Cain, Dr Andrew Davies, Mark Potter, Peter Iancov, Davyd Thomas, Mike Deeks, Dale Whelan, Stuart Purves, Jeff Murray, David Thompson and Michael Page.

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ISBN 978-0-646-98020-1

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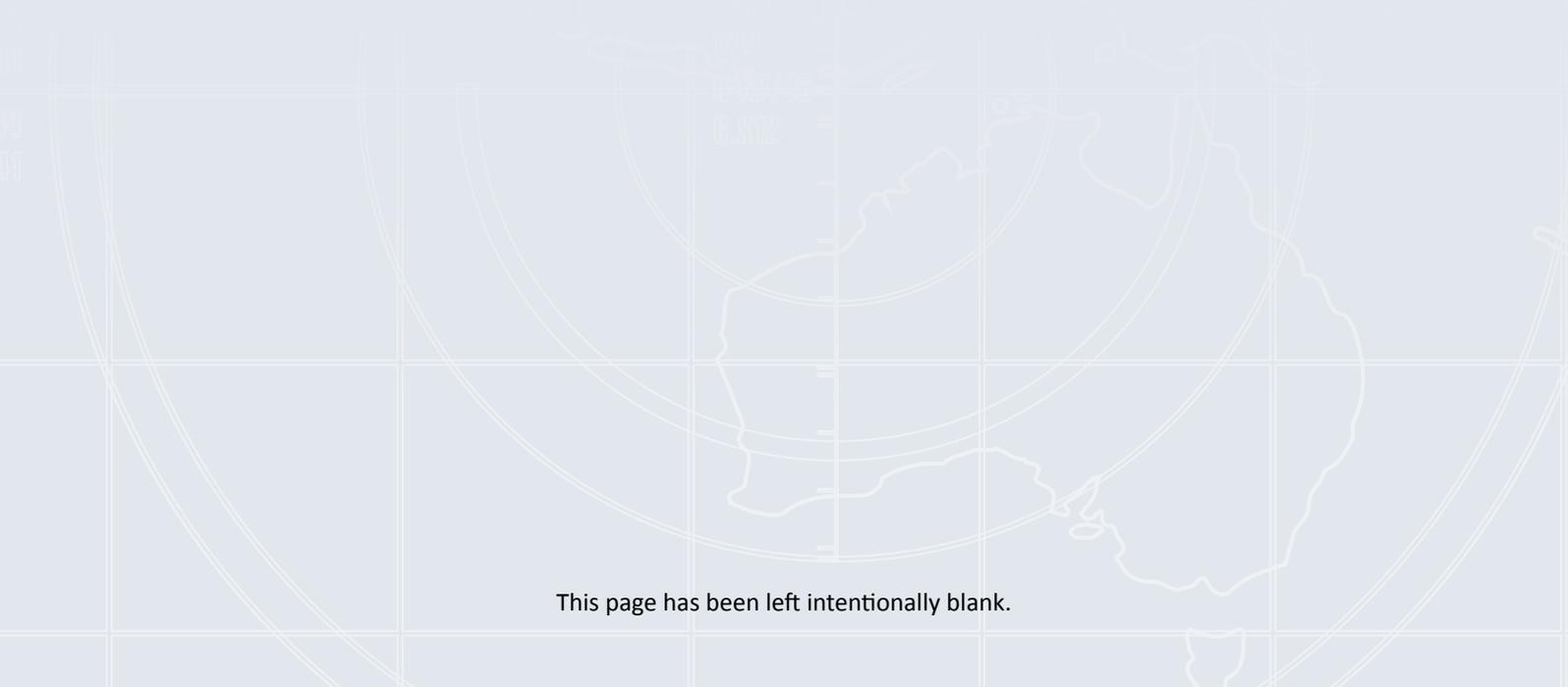
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Executive Summary

This report has been compiled to cast a light on the defence sector in Western Australia (WA). There is little analysis in the public domain about the sector, as a whole, across the State. The capabilities of the defence industry in WA, including that of local companies, are not necessarily well known. Just as importantly, there is little understanding of the broader potential for the defence sector in WA: geo-strategically, politically, economically and militarily. This report is particularly focused on the economic prospects of enhancing the defence presence and the defence industry within the State.

WA is the largest State, comprising almost one-third of Australia's entire territory. It also faces growth regions and significant waterways of the world – the Indian Ocean Region encompassing West, South and Southeast Asia, the Middle East, and East Africa. In addition to its substantial defence assets, WA hosts significant offshore infrastructure in the oil and gas industry. The State's north and north-western approaches, while strategically important, have become increasingly sensitive to security threats – particularly from unauthorised arrivals.

Many Indian Ocean states are increasing their defence expenditure, and have their own maritime security concerns. This creates excellent opportunities for Australian firms, with a burgeoning export market on our doorstep. There is the potential to achieve significant advantages from improved and expanded defence facilities in the State, including for Australia's allies – and not least allowing for naval facilities in the region for the United States (US), which is not only Australia's most stalwart ally, but also operates the largest navy in the world.

Defence department spending, resourcing and basing helps keep local economies buoyant. While there are already extensive Defence facilities across WA, although concentrated in the South West, there are, without doubt, significant opportunities for both synergies and new initiatives. This report's extensive analysis leads to conclusions that include the harnessing and nurturing of developments in the WA tertiary sector, technology transfer between the defence and resources sectors, and the defence and C4ISR sectors, the establishment of both an Undersea Centre of Excellence and a national space agency in the State, prospects to enhance defence exports, standing up an Indian Ocean Patrol Boat Program, and enhancing both Indigenous and Army capacities in WA.

This report is aimed at those in Federal, State, regional, and local government, and political representatives. It is also for those already in the defence industry, as well as those seeking to benefit from working in Defence or with Defence partners. It makes 25 specific recommendations, listed below, that target opportunities for enhancing this sector in WA, not only for economic growth and stability, but to take greater advantage of the State for Australia's, and WA's, long-term interests.

Recommendations

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Recommendations

For the Commonwealth Government:

1. Implement an Indian Ocean Patrol Boat Program, as part of Australia's broader foreign aid agenda in the Indian Ocean region. In a highly fractious part of the world, such a measure would strengthen regional stability, and further enhance Australia's profile and influence throughout the region.
2. Develop a plan to expand the Army in WA. Outside of the Special Air Service Regiment (SASR), the absence of Australian Regular Army forces on the western part of the Australian continent is notable. The Army's 7th Brigade, a multirole combat formation located in Brisbane, is heavily constrained by lack of space, urban encroachment and access to nearby training and manoeuvre areas. Therefore, either the entire brigade or elements of the brigade could be considered for relocation to the West.
3. Establish an annual joint naval exercise with France and India, two Indian Ocean powerhouses, as a key component of Australia's defence diplomacy in the volatile Indian Ocean region. This exercise could be rotated on an annual basis between the northern and western Indian Ocean, and the eastern Indian Ocean off the coast of WA.
4. Devise an annual joint Australia/US special forces training exercise in the North West of Australia. Since the SASR is already based in WA, the provision of such collaboration with Australia's key ally, which also has economic interests in the North West, could be organised within a relatively short timeframe.
5. Provide greater support to the Australian Defence attaches and advisors to promote the capabilities of Australian defence industry to foreign governments to maximise Australia's economic growth and export potential.
6. Host more defence supply chain roadshows throughout regional WA, that are incorporated into the regional economic development summits held annually, and undertaken in close collaboration with the Centre for Defence Industry Capability (CDIC), and the industry outreach programs of major Defence Primes.
7. Implement Defence Indigenous programs in WA, such as the Indigenous Pre-Recruit Program (IPRP), Defence Indigenous Development Program (DIDP), and the Army Indigenous Development Program (AIDP), as evidence of Defence's commitment to Closing the Gap in Indigenous disadvantage.
8. Rotate to WA the annual Defence Aboriginal and Torres Strait Islander Network (DATSIN) conference, which is the premier Defence forum aiming to further develop Indigenous initiatives in Defence. Hosting a future DATSIN conference in Perth would not only foster wide-ranging and lasting networks, but greater WA participation in the development of existing and future Indigenous programs in Defence.
9. Appoint WA-based Indigenous public figures, as ADF Ambassadors, to work in concert with Defence Force Recruiting and the ADF to help raise awareness of the career opportunities available to Indigenous Australians in Defence, and ensure that Indigenous communities across each of Regional WA's nine-sub regions are appropriately represented.
10. Expand existing cadet programs in WA, to accommodate more Indigenous youth. The benefits of wider engagement with Indigenous communities offers incalculable opportunities to provide Indigenous youth learning and developmental skills that would prepare them for the workforce, and, in particular, the real prospect of a full-time ADF career.
11. Provide funding to establish a Cooperative Research Centre (CRC) for Undersea Excellence in WA. Being the home of Navy's entire submarine fleet, a mature shipbuilding sector, and the epicentre of Australia's oil and gas sector, a strong rationale exists to fund this proposed initiative via a Defence Cooperative Research Centre.

For the WA Government:

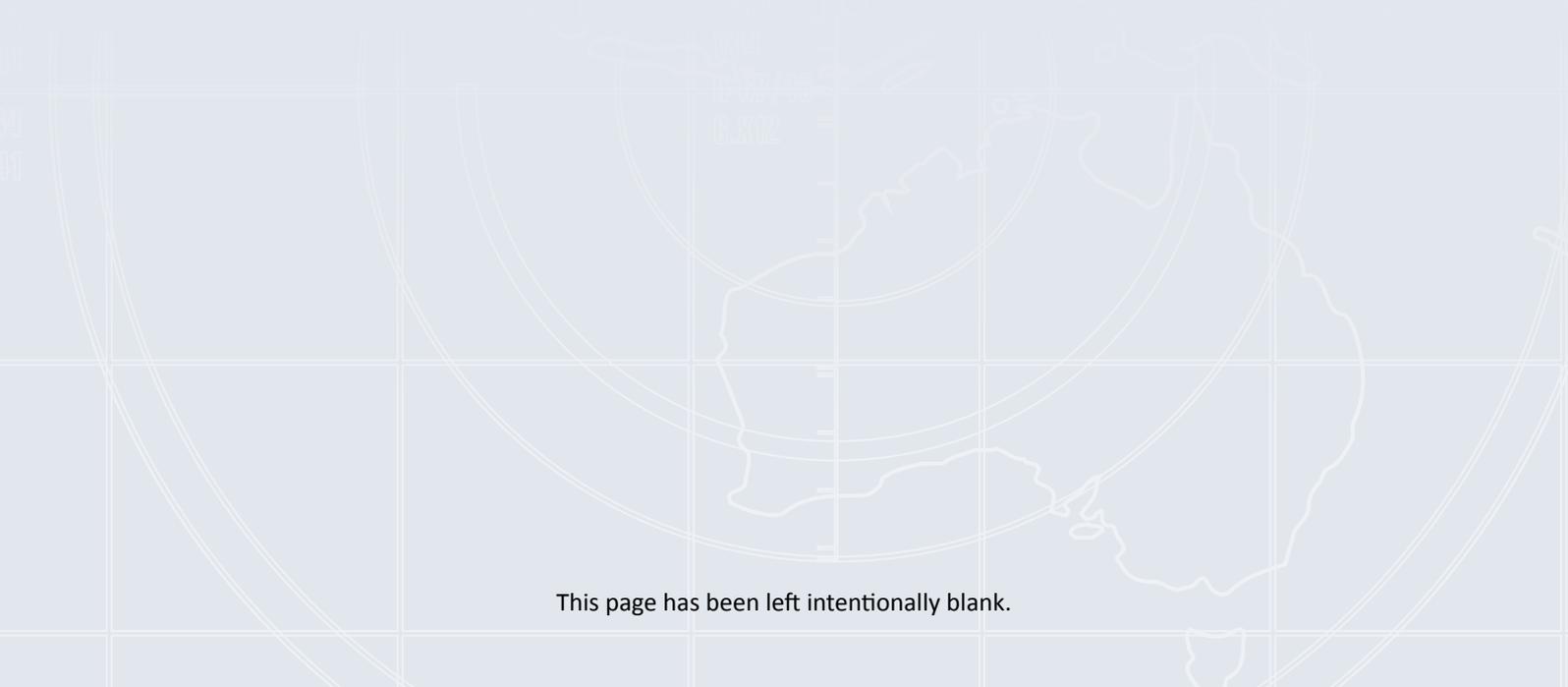
12. Establish a hub in WA, in cooperation with the Commonwealth, of the recently announced Defence CRC for autonomous systems proving ground in collaboration with the tertiary sector, to further develop this technology for both industry and Defence application.
13. Formulate a space plan for Western Australia. Advocate for the establishment of the national space agency, ideally in WA. This would leverage WA's growing space infrastructure to build on significant recent and emerging capabilities that have a range of applications, including Defence.
14. Provide further support to developing WA's internationally recognised cyber security capabilities, and assist in linking the tertiary sector to industry partners both domestically and internationally. This is particularly relevant in areas such as critical infrastructure security that spans commerce, industry and Defence requirements.
15. Institute a defence innovation and commercialisation fund to help augment local SMEs, including start-ups, that are seeking Commonwealth funding through the Defence Innovation Hub and/or, the Next Generation Technology Fund.
16. The Office of Defence West commission a comprehensive economic impact assessment to ascertain the full scope of economic opportunity that exists with Defence and defence industry in WA.
17. Strengthen the capacity for WA's advocacy, using examples of other states with the WA Government providing resources to develop a structure that can better drive results for the State on Defence projects.
18. Use existing WA Government trade offices to support defence industry efforts to expand into new export markets. Defence West should take the lead to work coordinate this activity with other State and Commonwealth Government agencies to engage new and emerging markets for local industry.
19. Expand the annual WA Innovator of the Year Award with the creation of a new defence industry category.
20. Ensure that there are adequate web and teleconferencing facilities available for businesses across Regional WA to participate in Perth-based Defence and defence industry seminars, workshops and events.
21. Develop training and workforce pathway programs for Indigenous Australians to facilitate opportunities for careers in Defence and defence industry.

For WA Local Government:

22. Commission studies that ascertain the economic impact and overall potential that Defence and defence industry presents to the future economic prosperity for local government areas that host Defence and/or defence industry infrastructure.
23. Foster linkages and sister-city relationships with key Asian, European or North American states, provinces and cities that have renowned industry capabilities that complement specific WA niche industries that have Defence application.

For WA Industry:

24. Enhance collaboration with the Office of Defence West, to foster a 'Team WA' approach to achieve strategic outcomes deemed important to the future of defence industry in WA.
25. That local defence industry peak bodies work collaboratively with recognised Indigenous certified organisations to develop policies that seek to attract and better integrate Indigenous Australians into the local workforce.



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Introduction

This report, the first of its kind, is aimed at informing readers about the current state of, and opportunities within, the defence sector in WA. It provides both a detailed overview of the current state of defence and related sectors, and identifies a number of recommendations that are drawn from the detail and analysis provided in the following chapters.

The report is structured along the following lines. Chapter One sets the scene by outlining the strategic significance of WA. WA is the largest State, comprising almost one-third of Australia's entire territory and faces growth regions and significant waterways of the world – the Indian Ocean region encompassing West, South and Southeast Asia, the Middle East, and East Africa. The State's north and north western approaches, while strategically important, have become increasingly sensitive after over a decade of unauthorised boat arrivals. In addition to substantial Defence assets, WA also hosts significant offshore infrastructure in the oil and gas industry.

Chapter Two provides an overview of Defence in the West. This includes Department of Defence (Defence) spending, facilities and bases, and a breakdown of bases and facilities by each Defence service. There are extensive Defence facilities and capabilities across the State, although they are mostly concentrated in the South West.

Chapter Three analyses the extant capabilities of WA's defence industry in great detail and includes a summary index of the key enterprises and institutions serving the defence sector.

The future for defence industry and defence innovation is the focus of Chapter Four. This chapter looks into opportunities for synergies with other sectors, and, in keeping with recent statements by the Minister for Defence Industry to expand Australia's defence exports, outlines which services and products in WA have the strongest defence export potential.

Drawing on the success of the Pacific Patrol Boat Program, Chapter Five makes the case for an Indian Ocean Patrol Boat Program. It also identifies opportunities for greater Indigenous involvement in Defence and defence industry, and argues there needs to be a much stronger Army presence in WA.

Throughout this report, tables and maps are provided to aid understanding of the defence sector in WA and for quick reference points to the analysis being provided. The report's extensive recommendations are listed above.

In short, this report encourages readers in the east to look west, and for local readers to learn much more about the opportunities that exist in the defence sector for their home State.

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Section 1

The Strategic
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Section 1: The Strategic Importance of Western Australia

As Australia's largest state geographically, WA sits astride the world's third-largest body of water, the Indian Ocean, and is strategically positioned at the cusp of the Asia-Pacific. WA has a wealth of natural resources, and plays a key role in the Commonwealth Government's overall defence posture. The State hosts a number of nationally significant facilities and capabilities that assist in monitoring and safeguarding Australia's northern and western approaches.

WA's contribution to Australia's economic success is disproportionately high, with the State being a significant contributor to the growth and sustainment of the national economy. It is coveted for its abundance of natural resources, and has some of Australia's, and the world's, largest infrastructure projects. In 2013, the North West of WA possessed 78% of Australia's crude oil, and 92% of its natural gas reserves, which contributed to approximately 4.5% of Australia's GDP.¹

In November 2016, WA's Gross State Product was approximately \$240 billion, which represented over 15% of Australia's total Gross Domestic Product (GDP).² Similarly, according to the Australian Petroleum Production & Exploration Association (APPEA), Australia is now the world's second-largest Liquid Natural Gas (LNG) exporter, and is forecast to be the world's largest LNG exporter by 2020.³ In 2014, WA also accounted for 37% of global iron ore production, and 49% of global iron ore exports.⁴

These facts highlight the centrality of WA's resources sector to Australia's economic prosperity, and further substantiate the comments, made seven years ago, by former Defence Minister Kim Beazley, who forecast that: "In the long-term the Indian Ocean is going to be massively more significant in global politics than it has ever been before, and that is the function largely of the fact that the Asia-Pacific region is massively more significant."⁵ He added: "The Asia-Pacific region covers both the Pacific and the Indian Ocean littoral's northern extension. Energy security and resources are absolutely critical. The Indian Ocean region is immensely rich in that and therefore all developing societies need access to the new material produced around the Indian Ocean littoral."⁶

Within Australia, interest and recognition of WA and the Indian Ocean's strategic importance, has fluctuated. In World War I (1914-18), WA's strategic importance was demonstrated with Albany and Fremantle serving as key dispatch points for tens of thousands of troops departing

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- 1 Griggs, VADM Ray. "Safeguarding Australia's Maritime Environment". *Port and Maritime Security Conference, Melbourne*. July 19, 2013. Accessed August 30, 2017: <http://bit.ly/2y8KLOh> .p.9.
 - 2 Government of Western Australia. "Western Australian Economic Profile". December 2016. Accessed August 30, 2017: <http://bit.ly/2ygkXQ3> .p.1
 - 3 Australian Petroleum Production and Exploration Association. "Export revenue". Accessed August 29, 2017: <http://bit.ly/2yLtcSh>.
 - 4 Government of Western Australia. "Western Australia Iron Ore Profile". March 2016. Accessed August 30, 2017: <http://bit.ly/2gOY8Fx>.p.1
 - 5 DeSilva Ranasinghe, Serge. "Kim Beazley on the Strategic Importance of the Indian Ocean", *Future Directions International Strategic Analysis Paper*. June 3, 2010. Accessed August 31, 2017: <http://bit.ly/2zGFMl7> .p.5.
 - 6 DeSilva-Ranasinghe, Serge. "Kim Beazley on the Strategic Importance of the Indian Ocean". 2010.

in convoys to theatres in the Middle East, Asia Minor and Europe. However, it was World War II (1939-45) that transformed WA. Three Army divisions were deployed, namely two militia divisions and one armoured division. From mid-1943 onwards, regular Catalina flying boat flights between the Swan River, Perth, and Koggala Lake, in southern Ceylon (now Sri Lanka) were undertaken. They had, by mid-1945, completed 271 crossings of the Indian Ocean, transported 648 passengers and flown in excess of than 1.5 million kilometres.⁷

“In the long-term the Indian Ocean is going to be massively more significant in global politics than it has ever been before...”



In addition, Fremantle port was established as the largest submarine base in the Southern Hemisphere. Operating out of Fremantle provided easier access to the Southeast Asian archipelago. As such, between 1942 and 1945 over 170 American, British and Dutch submarines operated out of Fremantle and conducted a total of 416 patrols.⁸ The strategic impact of Fremantle-based submarines against the Japanese war effort was considerable, as assessed by naval historian David Creed:

During the Second World War, Fremantle was developed into a major Allied submarine base. Submarines stationed at Fremantle were predominantly American, although the boats never formed more than a third of operational United States submarines in the Pacific. These boats sank more Japanese oil tankers than all other United States submarines combined and made a significant contribution to total merchant vessel and warship sinkings [sic]. In addition, two individual submarines based on [sic] Fremantle each sank more enemy shipping than any other Allied submarine in any theatre of war.⁹



Photo courtesy of Department of Defence

7 Qantas. “The Catalinas”. Accessed October 16, 2017: <https://www.qantas.com/travel/airlines/history-catalinas/global/en>

8 Cairns, Lynn. *Fremantle’s Secret Fleets*, Western Australian Maritime Museum, 1995, p.2.

9 Creed, David. *Operations of the Fremantle Submarine Base 1942-1945*, The Naval Historical Society of Australia Inc., Monograph No. 183, p.1.

With the advent of the Cold War (1947-1991), the escalating geo-political rivalry between the US and the Soviet Union, particularly from the early 1970s onwards, flowed into the Indian Ocean region. The Soviet Union's presence in the western Indian Ocean was a matter of growing concern to Australia, and spurred the *1971 Joint Committee on Foreign Affairs Report on the Indian Ocean Region*. This subsequently led to the first Commonwealth Parliamentary inquiry into the Indian Ocean in 1976.¹⁰

One of the key architects behind the 1971 Joint Committee, and the 1976 Parliamentary Inquiry, was former Senator Peter Sims, who later stated:

The Indian Ocean has been significant to Australia since our earliest history. As I have already stressed the Indian Ocean is an area which is in a state of flux and instability. The eventual outcome of the unsettled conditions of the region is far from clear. Australia, as a member country of the littoral, cannot disassociate itself from the events that will determine the history of the region. The Indian Ocean is of considerable political and strategic importance to Australia. It is crossed by sea and air communications vital to Australia. Much of the vital flow of oil to our neighbours and trading partners passes through it. Well over 50% of our total trade by tonnage passes through it. It is also an area of particular importance to our air communications with Europe, SE Asia and NE Asia.¹¹

“**HMAS Stirling is Australia's second-largest naval base, and remains the centrepiece of Australia's Indian Ocean military posture.**”



Defence planners, who had previously considered WA a low priority, became increasingly concerned over how to safeguard Australia's northern and western approaches. This increased interest ultimately led to the establishment of HMAS *Stirling* on Garden Island in 1978, and, in 1987, the relocation of a substantial proportion of the Royal Australian Navy (RAN) to WA, including the entire submarine command. This marked the beginning of the Two Ocean Navy policy. Since then, WA has no longer been considered a strategic backwater. Today, HMAS *Stirling* is Australia's second-largest naval base, and remains the centrepiece of Australia's Indian Ocean military posture.¹²

To uphold both national interests and alliance obligations, the Navy has deployed extensively to the western Indian Ocean region on a near constant tempo since the Second Gulf War (2003), undertaking maritime surveillance, anti-smuggling and counter-piracy patrols. In 2013, the former Chief of Navy, Vice Admiral Ray Griggs (now the Vice Chief of the Defence

10 *Australia and the Indian Ocean Region*, Parliamentary Paper No. 330/1976, Report from the Senate Standing Committee on Foreign Affairs and Defence, Canberra, 1977.

11 Sim, Peter. "The Indian Ocean: Historical and Future Perspectives" in Seminar on Australia and Indian Ocean, Esplanade Plaza Hotel, Fremantle, March 28-30, 1988, p. 10.

12 Upon seeking clarification on this point, a Defence spokesperson responded saying: "The reporting of HMAS *Stirling* as the largest base on the RAN internet site is incorrect and has been updated to reflect HMAS Cerberus as the largest Navy establishment (by area). Email correspondence with Defence Media, September 26, 2017.

Force), noted: “We’ve got about a third of the fleet based in Western Australia, operating in the Indian Ocean all the time. All of our major operational activity is focussed on the Indian Ocean today.”¹³ In 2015, the Chief of Navy, Vice Admiral Tim Barrett, confirmed: “We are just coming to rediscover some of the issues that might be the natural consequence of where controversy lies with the world. I think the Indian Ocean region has always held prominence, it’s just that our observation about which of those countries holds prominence has varied. We are increasingly looking to the Indian Ocean.”¹⁴

The reinvigorated interest in the Indian Ocean region is hardly surprising given that today it comprises 36 littoral states that account for 2.6 billion people which equates to 39% of the world’s population.¹⁵ The Indian Ocean is also host to some of the world’s most important sea routes with 50% of the world’s seaborne container traffic, and 33% of the world’s seaborne bulk cargo, transiting through its waterways annually.¹⁶

It has over 100,000 large vessels traversing its waterways annually, carrying two-thirds of the world’s oil shipments, and now surpasses the Atlantic and Pacific Oceans as the world’s busiest and most strategically important trade corridor.¹⁷

These, and other factors, have led the Commonwealth Government to enhance participation in key Indian Ocean multilateral forums, such as the Indian Ocean Rim Association (IORA) and the Indian Ocean Naval Symposium (IONS).¹⁸ In part, this is due to the fact that 57% of Australia’s mainland coastline is astride the Indian Ocean, compared to 27% astride the Pacific Ocean coastline, and 17% of coastline abutting the Southern Ocean.¹⁹ In addition, Australia has a massive accompanying Indian Ocean Exclusive Economic Zone (EEZ), and the largest maritime jurisdiction of any Indian Ocean littoral state.

13 DeSilva-Ranasinghe, Serge. “Evolution of the Two Ocean Navy”, *Extraordinary and Plenipotentiary Diplomatist*, October 2013.

14 DeSilva-Ranasinghe, Serge. “Beyond the Immediate Horizon”, *Naval Forces*, Vol.5, No. 36, 2015, p. 8.

15 There are in fact several competing definitions of what is considered the ‘Indian Ocean region’. Some interpretations have included hinterland states that are astride Indian Ocean littoral states, such as a Nepal, Lesotho, Swaziland and Ethiopia, all of which are heavily dependent on access to Indian Ocean waterways to conduct trade. For further information refer to: Amazon Web Services. “AWS Import/Export Developer Guide”. 2014. Accessed September 27, 2017: <http://bit.ly/2z95wul> .p. 9.

16 DeSilva-Ranasinghe, Serge. “Fact Sheet: The Indian Ocean Region and Australia’s National Interests”. *Future Directions*. May 29, 2012. Accessed September 27, 2017: <http://bit.ly/2y4Lwce>

17 Albert, Eleanor. “Competition in the Indian Ocean.” *Council on Foreign Relations*. May 19, 2016. Accessed October 08, 2017: <https://www.cfr.org/background/competition-indian-ocean> See also Bishop, Julie. “Indian Ocean Rim Association Dialogue in Perth”. *Media Release*. September 6, 2015. Accessed October 08, 2017: <http://bit.ly/2yKNmOT>

18 According to the Department of Foreign Affairs and Trade, Australia is a founding member, or a key supporter, of the principal regional organisations and other forums in the Indian Ocean. They include the: Indian Ocean Rim Association (IORA), Indian Ocean Naval Symposium (IONS), Indian Ocean Tuna Commission (IOTC), Indian Ocean MOU (IOMOU) on Port State Control, UNESCO Intergovernmental Oceanographic Commission (IOC) Perth Regional Program Office, UNESCO IOC Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System (ICG/IOTWS). For further details see: Department of Foreign Affairs and Trade. “Indian Ocean regional forums”. Accessed September 27, 2017: <http://bit.ly/2gAam92>

19 For the Australian mainland coastline (excluding all of Australia’s territories – the use of the Australian Antarctic Territory would significantly skew these figures). The facing coastline for the Indian Ocean, in terms of the Australian mainland and islands, is considered to extend from Slade Point on Cape York, on the western side of the Torres Strait, to Cape Leeuwin in the South West of Western Australia. The coastline facing the Southern Ocean is considered to extend from Cape Leeuwin to South East Cape, Tasmania. The coastline facing the Pacific Ocean is considered to extend from South East Cape to Slade Point on Cape York and includes Torres Strait. Email correspondence. Grant Boyes, Principal Maritime Boundaries Adviser, Geoscience Australia. February 14, 2014.

56%

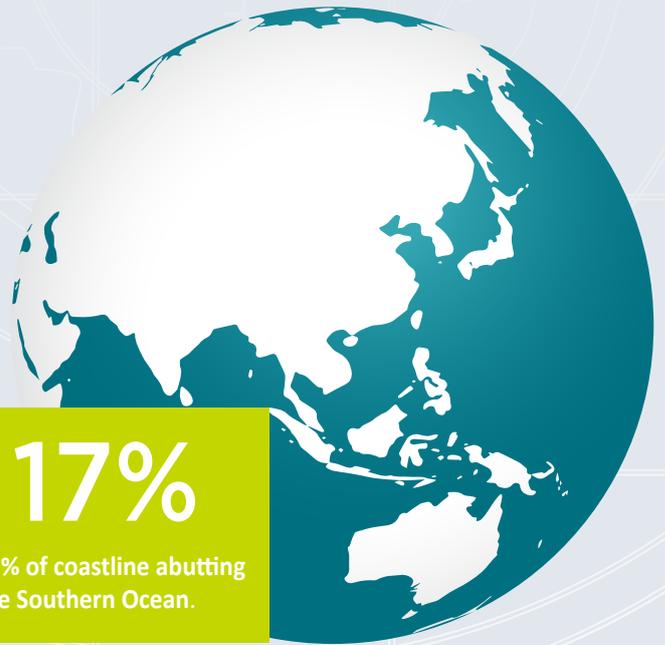
56% of Australia's mainland coastline is astride the Indian Ocean, compared to

27%

27% astride the Pacific Ocean coastline, and

17%

17% of coastline abutting the Southern Ocean.



The increasing Commonwealth interest in the Indian Ocean region, in recent years, is also due to the considerable expansion in trade and investment ties throughout the region. For example, six of Australia's top 15 trading partners are from the Indian Ocean region: Singapore, Thailand, Malaysia, India, Indonesia, and the United Arab Emirates (UAE).²⁰ These and other salient case studies include:

- Africa: Australia is one of the top investors in mineral exploration in Africa. According to the Australia-Africa Minerals and Energy Group, in 2016 there were more than 170 Australian Stock Exchange-listed mining and other resource companies operating over 400 advanced projects in some 35 African countries. Australian-listed companies control more than 48 mining operations in Africa.²¹

- South Asia: In 2014-15, 1,946 Australian businesses were exporting to India. According to Austrade, Australia-India bilateral trade is presently estimated at \$19.8 billion, in 2015, Indian foreign investment into Australia was valued at \$11.6 billion, and Australian investment in India was estimated at \$1.5 billion.²²
- Middle East: 360 Australian companies and 23,000 Australians live in the UAE.²³



Six of Australia's top fifteen trading partners are from the Indian Ocean region

20 Department of Foreign Affairs and Trade. "Australia and the Indian Ocean Region". Accessed September 27, 2017:

<http://dfat.gov.au/international-relations/regional-architecture/indian-ocean/Pages/indian-ocean-region.aspx>

21 AAMEG. *Australia's Trade and Investment Relationships with the Countries of Africa*. AAMEG Submission to the Foreign Affairs, Defence and Trade References Committee of the Australian Senate, August 18, 2017. p. 5.

22 Australian Trade and Investment Commission. "Austrade's export opportunities to India". Accessed August 29, 2017:

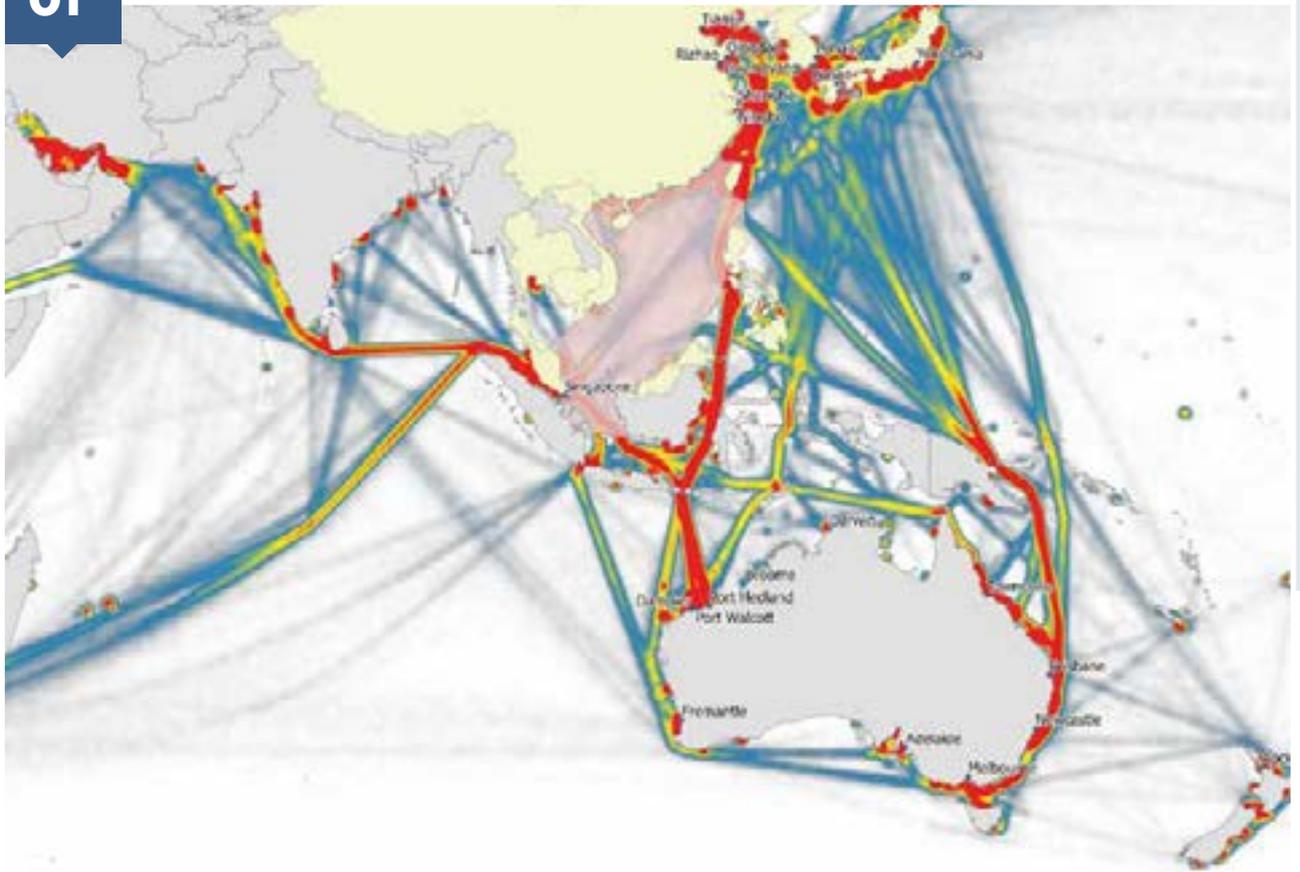
<https://www.austrade.gov.au/Australian/Export/Export-markets/Countries/India/Market-profile>.

23 Radan, Silvia. "UAE-Australia relations: Growth beyond recognition." *Khaleej Times*. January 2, 2016. Accessed August 29, 2017:

<http://www.khaleejtimes.com/business/markets/uae-australia-relations-growth-beyond-recognition>.

Figure
01

Key Indian Ocean and Asia Pacific Sea Lanes



Source: Lloyds List Intelligence 2016.

Conversely, Australia's growing economic ties to the Indian Ocean region have also raised national security concerns, as potential threats to Australia emerge from the region. The combination of population pressures, state instability and fragility, impacts of climate change, piracy, militarisation and conflict, and associated people movements, make the region one of unquestionable sensitivity. Fragile or failed states include Somalia, Yemen and Myanmar, and the escalating rivalry between Saudi Arabia and Iran that overshadows much of the politics of the Middle East. Similarly, at least four Indian Ocean regional powers possess long-range missile systems of varied capabilities: India, Iran, Pakistan and Saudi Arabia.

Of particular concern is the historic rivalry between nuclear-armed India and Pakistan that shows few signs of abating, and adds another layer of complexity to the region's geopolitical tapestry. Although Northeast Asia, as is the case at the moment, frequently appears in the news as the global epicentre of nuclear confrontation, South Asia has the potential to be just as volatile. Tensions between India and Pakistan have simmered for decades with South Asia perennially on the cusp of being a nuclear flashpoint. A case in point was in 2013, when the former Commander-in-Chief of the US Strategic Command Eugene Hablger, observed: "You have two nations that have rattled their nuclear sabres more than the Soviets and United States did in the entire course of the Cold War".²⁴

24 "The Day Clinton Stopped Pakistan from Nuking India, July 4, 1999". August 19, 2013. Accessed August 29, 2017: <https://www.youtube.com/watch?v=TTNRU607Zxl>.(viewed at timecode 9.35)

The escalating geo-political rivalry in the Indian Ocean region is particularly apparent between China and India: two of the world's emerging powerhouses. The economic rise of both countries has inexorably altered the Indian Ocean region in a manner not seen since the end of the Cold War. This in turn has contested, and eroded, the traditional extra-regional dominance enjoyed by the West, namely the US, United Kingdom and France, three countries that have a substantial military presence in the western and/or central Indian Ocean.²⁵ Evidence of major geo-political shifts has, in recent years, been acknowledged in an array of key Commonwealth Government policy documents, such as the *2016 Defence White Paper*, which concluded:

The Indian Ocean has become an important focus for Australian strategic policy in recent years. Vital trade and energy routes for Australia and many of our most important economic partners transit the Indian Ocean. Over the next 20 years, the Indian Ocean will see a substantial increase in intra-regional maritime trade, including in energy, food and other natural resources. The Indian Ocean region is also likely to become a more significant zone of competition among major powers, with China, India and the United States all increasing their levels of military activity in this region.²⁶

The heightened geo-political activity in both the Indian Ocean region and the Asia-Pacific has given added impetus to the informal defence forum, the Five Power Defence Arrangements (FPDA), comprised of Australia, Britain, Malaysia, New Zealand and Singapore.²⁷ Similarly, the US rebalance to the Asia-Pacific, which began under former President Barack Obama, has enhanced the strategic importance of Australia to the US, with WA emerging as a vital strategic nexus between the Indian Ocean and the Asia-Pacific regions; a zone that is increasingly referred to in official lexicon as the 'Indo-Pacific' or 'Indo-Asia-Pacific'.

The rise of India, as a significant regional and global economic power, has enabled it to increasingly assert influence throughout the Indian Ocean region, and beyond. India is currently the second-most populous nation in the world, with over 1.3 billion people, just behind China (although the accuracy of Chinese figures has been questioned).²⁸ In competing with China to be the regional hegemon, India is actively positioning itself to emerge as the dominant Indian Ocean power. In 2017, India not only ranked as the world's seventh-largest economy, but was recognised by the World Bank as the world's fastest growing economy.²⁹ Similarly, India has invested considerable resources into developing its military capabilities, most notably an increasingly blue water capable navy, which is the fifth-largest in the world, replete with aircraft carriers and submarines.³⁰

25 DeSilva-Ranasinghe, Serge. "The Indian Ocean is Fundamental to UK Interests – Admiral Sir Trevor Soar, Royal Navy". January 27, 2012. Accessed September 27, 2017: <http://bit.ly/2glzcGX>. See also Verma, Bharat. "French Forces in Indian Ocean". December 1, 2010. Accessed September 27, 2017: <http://www.indiandefencereview.com/news/french-forces-in-indian-ocean/>

26 Department of Defence. *2016 Defence White Paper*. February 24, 2016. Accessed August 30, 2017: <http://www.defence.gov.au/whitepaper/docs/2016-defence-white-paper.pdf>

27 Dobell, Graeme. "The durian pact: the Five Power Defence Arrangements". The Australian Strategic Policy Institute: The Strategist. June 5th 2017. Accessed November 12, 2017: <https://www.aspistrategist.org.au/durian-pact-five-power-defence-arrangements/>

28 The World Bank. "Population 2016". 2016. April 17, 2017. Accessed September 02, 2017: <http://bit.ly/2iPuJ67> p.1; Phillips, Tom and Michael Safi. "India is world's most populous nation with 1.32 billion people, academic claims". *The Guardian*. May 24, 2017. Accessed September 2, 2017: <http://bit.ly/2lhw1B1>

29 Grey, Alex. "The World's Biggest Economies in 2017", March 9, 2017. Accessed October 8, 2017: <http://bit.ly/2zEqSfk> See also: World Bank. "India's Economic Fundamentals Remain Strong: Pick-up Needed for Sustained Growth". May 29, 2017. Accessed October 8, 2017: <http://bit.ly/2h9WgLR>

30 Southfront. "Military Analysis: Indian Navy". Accessed October 08, 2017: <https://southfront.org/military-analysis-indian-navy/>

As Australia's closest Southeast Asian neighbour, the ascent of Indonesia is also notable as the world's fourth most populous nation, with 261 million people.³¹ Indonesia is the world's 10th largest economy in terms of purchasing power parity, the largest economy in Southeast Asia and a G-20 member.³² According to IHS Markit, Indonesia will have the fifth fastest-growing defence budget in the world between 2016 and 2025.³³

Recognising the significant geo-political shifts in the Indian Ocean region, in May 2017, the former Defence and Foreign Minister, Stephen Smith, said: "It's more than just West Australians flying to Canberra that will have the effect on our national consciousness, it will be the rise of India and the rise of Indonesia. What will drive the increased focus on the Indian Ocean and Western Australia, with Perth as our Indian Ocean capital and port, won't be the valiant, but good efforts of West Australians, it will be the geo-political reality that India and Indonesia are significant players."³⁴

Yet, evidence of geo-political change in the Indian Ocean region, is also due to other countries expanding capacities and interests. Over the last decade this has been particularly notable with China funding or seeking to invest in the construction of major new ports in Kenya (Lamu), Myanmar (Kyaukpyu), Pakistan (Gwadar), and Sri Lanka (Hambantota), which are likely to exert a defining role in China's "One Belt, One Road" policy to further consolidate its strategic influence.³⁵ The development of new strategic trade routes has enabled China consolidate access into East Africa, as in the instance of Lamu, which has been reinforced by the establishment of a Chinese military 'logistics base' in Djibouti,³⁶ and bolstered economic connectivity with China's southern and western provinces to the Indian Ocean, as in the cases of Gwadar and, in the near future, Kyaukpyu.³⁷

“What will drive the increased focus on the Indian Ocean and Western Australia, with Perth as our Indian Ocean capital and port, won't be the valiant, but good efforts of West Australians, it will be the geo-political reality that India and Indonesia are significant players.”



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- 31 The World Bank. "Population total". Accessed October 14,, 2017: <https://data.worldbank.org/indicator/SP.POP.TOTL> p.1
- 32 The World Bank. "Indonesia Overview". April 10, 2017. Accessed August 30, 2017: <http://bit.ly/2zFge85>
- 33 IHS Markit. "\$20 Billion Defence Budget Boom in Indonesia, IHS Markit Says". Accessed September 2, 2017: <http://bit.ly/2zQyL1Q>
- 34 Interview with former Defence and Foreign Minister Stephen Smith, May 15, 2017.
- 35 Craw, Victoria. "China's Belt and Road Initiative could redraw the map on global trade". *News.com.au*. July 23, 2017. Accessed October 13, 2017: <http://bit.ly/2zEg1lt>; Wade, Geoff. "China's 'One Belt, One Road' initiative." Parliament of Australia. May 11, 2017. Accessed August 30, 2017: <http://bit.ly/2ySli7R>
- 36 Bhat, Vinayak. "China's mega fortress in Djibouti could be model for its bases in Pakistan. *The Print*. September 27, 2017. Accessed October 13, 2017: <https://theprint.in/2017/09/27/china-mega-fortress-djibouti-pakistan/>
- 37 China is presently in negotiations to massively redevelop the Kyaukpyu deep sea port. See Yimou Lee and Shwe Yee Saw Myint. "Exclusive: China seeks up to 85 percent stake in strategic port in Myanmar". *Reuters*. May 5, 2017. Accessed October 13, 2017: <http://reut.rs/2yKF35N>

Figure
02

China's One Belt, One Road Initiative



Source: The Economist. Accessed October 17, 2017: <http://econ.st/2yLRw9m>

The ascending Chinese profile has also been accompanied by a rising military profile. A case in point was demonstrated in July 2017, in an editorial by *India Today*, which claimed that up to 14 Chinese warships were active in the Indian Ocean region, in a marked increase from previous years.³⁸ In just the last 12 months, the changing balance of power in the region has enabled China to further extend its influence through strategic arms transfers with several countries either modernising, expanding, or acquiring, submarine capabilities.

For instance, in 2016 China confirmed the sale of eight submarines to Pakistan,³⁹ and two submarines to Bangladesh.⁴⁰ In May 2017, Thailand purchased the first of three submarines from China.⁴¹ These are significant – and historically unprecedented – developments since neither Bangladesh nor Thailand have previously possessed a submarine capability, and indicate the contestation against, and the decline of, traditional extra-regional influence. These acquisitions give further weight to the assessment that approximately half the world's submarines will be active in the general zone comprising the Indo-Pacific region.⁴²

38 Borgohain, Sonalee. "China deploys submarine in Indian Ocean Region even as India-China standoff continues." *India Today*, July 4, 2017. Accessed August 30, 2017: <http://bit.ly/2gNzcp7>.

39 Gady, Franz-Stefan. "China Confirms Export of 8 Submarines to Pakistan". *The Diplomat*. October 19, 2016. Accessed August 30, 2017: <http://thediplomat.com/2016/10/china-confirms-export-of-8-submarines-to-pakistan/>.

40 Herzinger, Blake. "Submarines in the Bangladesh Navy: Acquired Deterrence or Strategic Misstep?" *The Diplomat*. December 21, 2016. Accessed August 30, 2017: <http://bit.ly/2zQHRM7>.

41 Reuters. "Thai navy defends submarine purchase, shrugs off criticism." May 1, 2017. Accessed August 31, 2017: <http://reut.rs/2yMb798>

42 Department of Defence. *Naval Shipbuilding Plan*. 2017. Accessed October 8, 2017: <http://bit.ly/2gRpvIQ> p. 32.

“ ... the rising profile of Defence in WA, particularly with base and capability upgrades, is an indicator that the State is receiving greater emphasis in current and future defence and strategic planning.”



While modernisation and upgrades are not necessarily signs of an offensive capability, particularly in countries that have strong ties to Australia, the combination of these factors is nonetheless concerning, and has compelled Australian Defence planners to increasingly view the region surrounding Australia’s vast northern and western approaches with growing attentiveness. The strategic importance of the western flank of the Australian continent will continue to rise in the years, and decades, ahead. Consecutively, the rising profile of Defence in WA, particularly with base and capability upgrades, is an indicator that the State is receiving greater emphasis in current and future defence and strategic planning. This will serve to further consolidate Defence, and defence industry, in the West.



Photo courtesy of Department of Defence

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Section 2

A Profile of Defence
in the West



Section 2: A Profile of Defence in the West

Although subsumed by an east coast-focussed policy establishment, WA retains national significance to Defence. Since the Two Ocean Navy policy of 1987, there has been a substantial increase of ADF personnel in WA, and ongoing investment in Defence infrastructure. As of 2015-16, aggregate Defence expenditure in WA amounted to over \$1.2 billion being spent on Defence personnel, equipment, services and facilities in the State.⁴³ By and large, as pointed out in ‘Table 1: Composition of Defence Personnel in Western Australia (2016)’, the State cumulatively represents 7.1% of the total number of Department of Defence personnel in Australia.

Table 1: Composition of Defence Personnel in Western Australia (2016)

Service	Total Number of Regular Personnel and Percentage of ADF Regulars in WA	Total Number of Reserve Personnel and Percentage of ADF Reserves in WA	Combined Number of Regular/Reserve Personnel and Percentage of ADF Forces in WA	Total Number of Defence Australian Public Service Personnel in WA and Percentage of Defence APS Personnel in WA
1. Army	864 (2.9%)	1,494 (11%)	2,358 (5.4%)	n/a
2. Air Force	320 (2.2%)	282 (5.9%)	602 (3.2%)	n/a
3. Navy	2,320 (16.5%)	355 (11%)	2,675 (15.5%)	n/a
4. Defence Australian Public Service	n/a	n/a	n/a	493 (2.6%)
Total	3,504 (6%)	2,131 (9.9%)	5,635 (7.1%)	493 (2.6%)

Source: “Section 7 – Strategic Workforce Planning”. *Defence Annual Report 2015-16*. Accessed October 8, 2017: <http://www.defence.gov.au/AnnualReports/15-16/Chapters/chapter-7.asp>

43 Personal communications with the Department of Defence and other sources.



As of 2015-16 aggregate Defence expenditure in WA amounted to over \$1.2 billion being spent on Defence personnel, equipment, services and facilities

Currently, according to the Estate and Infrastructure Group, Defence in WA either owns or leases 114 properties, 1,785 buildings and a land area consisting of 182,766.26ha throughout the State.⁴⁴ After many years of neglect in infrastructure, in 2016 Defence finally announced that between 2016 and 2025-26, in excess of \$2 billion will be invested in upgrading Defence facilities in WA. Similarly, between 2025-26 and 2035-36, nearly \$2 billion in additional funding is forecast for more upgrades of WA-situated Defence facilities.⁴⁵

2.1 Joint Elements and Agencies

There are a number of Defence elements and agencies that operate in WA, providing a variety of capabilities deemed nationally important. WA is home to key Defence facilities such as Joint Logistics Unit-West (JLU-West), Naval Communications Station Harold E. Holt (COMMSTA), Australian Defence Satellite Communications Station (ADSCS), Jindalee Operational Radar Network (JORN), Defence Science and Technology Group (DST Group, formerly the Defence Science and Technology Organisation), Capability, Acquisition and Sustainment Group (CASG), and a number of other smaller agencies.

All Australian Defence Force (ADF) activities in the State are supported by JLU-West, which is headquartered at HMAS *Stirling*, with satellite offices at Palmer Barracks and RAAF Pearce. JLU-West serves as the primary storage and maintenance facility in WA, and hosts the ADF's second-largest armoury, and retains all spare parts for ADF equipment and vehicles in the State. JLU-West is responsible for warehousing, inventory, sourcing and pre-positioning of equipment and spares, weapons storage and testing, and regional explosive ordnance services for all three services. A feature of JLU-West is its armoury, which includes a weapons-test firing facility, allowing for the measurement of weapon velocities and accuracy. The armoury acts as a storage location from which weapons can be despatched throughout WA, and to the Middle East Area of Operations (MEAO).⁴⁶

The Naval Communications Station Harold E. Holt (COMMSTA), is Navy's main Very Low Frequency (VLF) transmission station in the Southern Hemisphere, located near Exmouth on the North West Cape of Australia. The COMMSTA facility provides a unique communications capability for Australian and Allied submarines operating in the Indian Ocean and Asia-Pacific regions. COMMSTA is

44 Personal communication with Gavin Nicholls, Director, Estate and Facilities Services, Service Delivery Division – East & West Zone, Estate and Infrastructure Group. November 11, 2015.

45 Personal communications with the Department of Defence and other sources.

46 DeSilva-Ranasinghe, Serge and Sutton, Mitchell. "Supply on Demand: Joint Logistics Unit-West". *Contact Air, Land and Sea*. December 2016. Accessed September 27, 2017: <https://issuu.com/contactpublishing/docs/contact52a/28> pp. 28-31.

scheduled for a \$200-300 million upgrade,⁴⁷ expanding its role in partnership with the relocation of the C-Band Space Surveillance Radar System.⁴⁸ The initial construction phase began in March 2017.⁴⁹ In addition, the Space Surveillance Telescope, sold to Australia by the US Air Force and scheduled for transfer from Antigua in the Caribbean, will be co-located at COMMSTA and made operational by 2020.⁵⁰ The telescope is capable of detecting and tracking space debris, and other small objects orbiting the earth, making COMMSTA integral to the US Space Surveillance Network.⁵¹

The Australian Defence Satellite Communications Station (ADSCS) at Kojarena, east of Geraldton, WA, is a critical joint satellite surveillance centre, and ground station for the US Wideband Global System of satellite communications that is operated by the Australian Signals Directorate.⁵² The importance of the ADSCS is increasingly significant with the heightened risk of cyber security attacks and the network-centric nature of future warfare. The ADSCS is presently undergoing a major upgrade with a new satellite communications facility as part of \$94 million JP 2008 Phase 3F contract, which is scheduled for completion in late 2017.⁵³

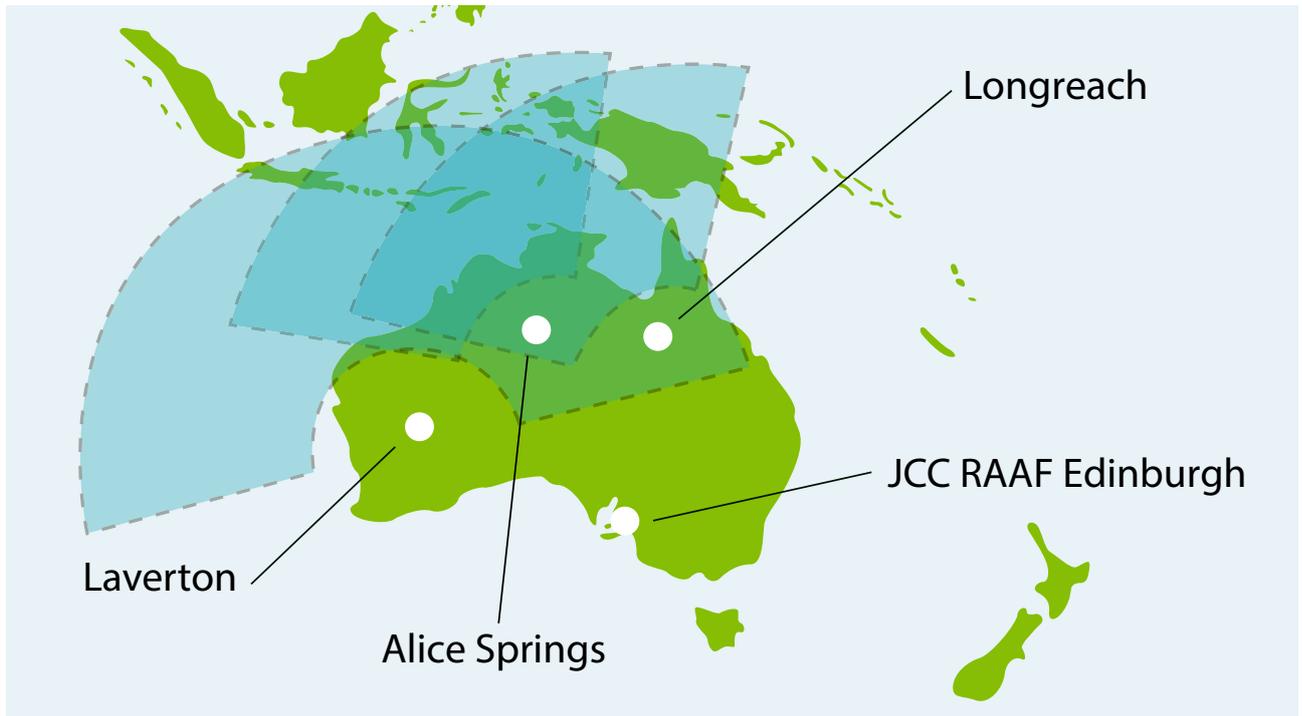
“The importance of the ADSCS is increasingly significant with the heightened risk of cyber security attacks and the network-centric nature of future warfare.”



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- 47 Department of Defence. *2016 Defence Integrated Investment Program*. 2016. Accessed August 31, 2017: <http://bit.ly/2iheoDj> . p. 62.
- 48 Department of Defence. “Australia’s Space Surveillance Radar reaches Full Operational Capability”. March 7, 2017. Accessed August 31, 2017: <http://bit.ly/2igZZHj>.
- 49 Hartigan, Brian. “C-Band Space Surveillance Radar fully operational in WA.” *Contact Air, Land and Sea*. March 8, 2017. Accessed August 31, 2017: <http://www.contactairlandandsea.com/2017/03/08/c-band-radar/>
- 50 Foust, Jeff. “DARPA Hands Over Space Tracking Telescope to the Air Force”. *Space.com*. October 19, 2016. Accessed September 27, 2017: <https://www.space.com/34452-darpa-hands-over-space-tracking-telescope-to-the-air-force.html>; Department of Defence. “Australia’s Space Surveillance Radar reaches Full Operational Capability”. March 7, 2017.
- 51 Foust, Jeff. “DARPA Hands Over Space Tracking Telescope to the Air Force”. 2017.
- 52 Nautilus Institute for Security and Sustainability. “Australian Defence Satellite Communications Station, Kojarena”. October 6, 2014. Accessed September 27, 2017: <http://bit.ly/2xDUvNh>
- 53 Defense-Aerospace.com. “Australia and United States Defence Satellite Communications Cooperation at Geraldton”. July 21, 2008. Accessed September 27, 2017: <http://bit.ly/2ly6euT> ; “BAE Systems wins SATCOM contract”. *Australian Defence Magazine*. September 18, 2017. Accessed September 28, 2017: <http://www.australiandefence.com.au/6FE012F8-5056-8C22-C9D39DC99A192DDA> ; Department of Defence. “Military Satellite Communications”. Accessed September 28, 2017: <http://www.australiandefence.com.au/6FE012F8-5056-8C22-C9D39DC99A192DDA>

Figure
02

JORN Radar Locations and Coverage



Source: Royal Australian Air Force. Accessed October 17, 2017: https://www.airforce.gov.au/docs/JORN_Fact_Sheet.pdf

Operated by the Royal Australian Air Force's No. 1 Radar Surveillance Unit based out of RAAF Edinburgh in South Australia, the Jindalee Operational Radar Network (JORN) is Australia's first air and surface early warning system, playing a salient role in monitoring Australia's northern and western approaches. The JORN operates three separate Over-The-Horizon-Radar (OTHR) systems that emanate and reflect high frequency radio signals off the ionosphere to detect aircraft and boats. The three OTHR facilities are located at Laverton, WA, Alice Springs in the Northern Territory, and Longreach, Queensland respectively.⁵⁴

The DST Group has maintained a presence in WA since 1996, based at HMAS *Stirling*. It comprises 40 personnel from the Maritime Division, five from Joint Operations Analysis

Division, and one person from Weapons and Countermeasures Division. The Maritime Division consists of a combat system architectures and analysis, human systems and information integration, passive sonar, power and energy systems, and acoustic signature management.

The Joint Operations Analysis Division focuses on maritime systems analysis, whereas the Weapons and Countermeasures Division purview is information processing and human systems. DST Group has five purpose-built facilities in WA, which include a submarine combat system, a sonar replacement and processing laboratory, a sonar sensors laboratory, an optronics synthetic imagery laboratory, and a submarine human systems integration laboratory.⁵⁵

54 Royal Australian Air Force. "Fact Sheet – Jindalee Operational Radar Network". Accessed September 28, 2017: <http://bit.ly/2igFRF3> p.1-6.

55 Personal communications with Department of Defence and other sources.

Table 2: Joint Defence Installations in Western Australia

Facility	Functionality	Local Government Area	State Electorate	Federal Electorate
1. Joint Logistics Unit-West	JLU-West has a staff of around 150; 40 ADF and 30 APS personnel, and 80 contractors from logistics and clothing supply companies.	City of Rockingham (HMAS Stirling)	Rockingham	Brand
		City of Swan (Palmer Barracks)	Midland	Hasluck
2. Naval Communications Station Harold E. Holt	As the Navy's main VLF transmission station in the Southern Hemisphere, Naval Communications Station Harold E. Holt, known as COMMSTA, is located near Exmouth on the strategic North West Cape of Australia. It provides VLF communications to Australian and Allied submarines operating in the Indian Ocean and Asia Pacific regions.	Shire of Exmouth	North West Central	Durack
3. Australian Defence Satellite Communications Station	As a key critical joint satellite surveillance centre, the ADSCS is a ground station that is linked to the US Wideband Global System of satellite communications, and is operated by the Australian Signals Directorate.	City of Greater Geraldton	Geraldton	Durack
4. Jindalee Operational Radar Network (JORN)	JORN comprises three Over-The-Horizon Radar systems situated at three separate locations, and forms part of a layered surveillance network providing coverage of Australia's northern approaches.	Shire of Laverton	Kalgoorlie	O'Connor

CASG, formerly the Defence Materiel Organisation, is staffed by both ADF and Australian Public Service (APS) personnel, and supported by Defence prime contractor staff in WA, numbering in total between 200-300 personnel. It is the lead agency that interfaces between Defence and prime contractors through six satellite System Program Offices (SPOs) located in WA.

Table 3: Defence System Program Offices in Western Australia

Office	Functionality
1. Anzac System Program Office (ANZSPO)	Based at Rockingham and comprising 76 staff, the ANZSPO is responsible for managing and monitoring the in-service sustainment and generation activities for the ANZAC Class of warships through the implementation of the Warship Asset Management Agreement.
2. Amphibious Afloat Support System Program Office (AAS-SPO)	The AAS-SPO satellite office in WA employs six staff. It administers the sustainment of HMAS <i>Sirius</i> , one of the Navy's principal refuelling vessels.
3. Training Aircraft System Program Office (TASPO)	TASPO is based at RAAF East Sale, but has a small attachment at RAAF Pearce that oversees the contract maintenance of PC-9 training aircraft used by 2 FTS (Flying Training School).
4. Submarine Sustainment Office– Fleet Base West (SSO-FBW)	The SSO-FBW is responsible for managing and monitoring the in-service sustainment of the Navy's Collins Class submarines.
5. Radio Frequency System Program Office (RFSP0)	RFSP0 satellite office in WA is situated at Exmouth. It is responsible for the maintenance and operation of the Naval Communications Station Harold E. Holt.
6. Maritime Explosive Ordnance System Programme Office (West) (MEOSPO-W)	The MEOSPO-W is a satellite attachment based at Fleet Base West (Garden Island) responsible for managing and monitoring the in-service sustainability of maritime ammunition, guided missiles, torpedoes and decoy systems.

Other smaller Defence agencies located in WA include Defence Estate and Infrastructure Group, Joint Health Command, Australian Government Security Vetting Agency, Defence People Group, Defence Community Organisation and the Centre for Defence Industry Capability (CDIC).

2.2 Royal Australian Navy

As the largest service arm of the ADF in WA, the Royal Australian Navy (Navy) in the West is located at HMAS *Stirling* on Garden Island.⁵⁶ The docking and wharf area of the base, referred to as Fleet Base West, is the homeport to five of Navy's eight ANZAC Class Frigates (HMASs *Arunta*, *Perth*, *Stuart*, *Toowoomba* and *Warramunga*), all six Collins Class submarines (HMASs *Collins*, *Dechaineux*, *Farncomb*, *Rankin*, *Sheean* and *Waller*) and support ship HMAS *Sirius*. A number of smaller boats are also based there, including fuel lighters and the MV *Besant* and MV *Stoker*, used in support of submarine rescue, training other support maritime activities.

HMAS *Stirling* hosts 2,460 navy personnel, 322 civilian Defence staff, 500 long-term contractors and 320 short-term workers. Of these, around 1,400 are attached to land-based units permanently

56 Royal Australian Navy. "HMAS Stirling". Accessed October 8, 2017: <http://www.navy.gov.au/establishments/hmas-stirling>

residing on the base, with a further 1,060 serving aboard vessels.⁵⁷ The base is large enough to be a major economic generator to the region with the City of Rockingham and adjacent suburbs being recipients of spending of an estimated \$100 million in salaries.⁵⁸

The base is also the home of Clearance Diving Team 4 (AUSCDT4), a highly versatile naval special forces unit, and one of Navy's two permanent clearance diving teams, comprising a headquarters and tactical operations, counter-mine and battle damage repair elements. Furthermore, the base hosts a key ADF space and satellite communications facility, known as Defence Communications Station (DEFCOMMSTA), an ultra-high frequency satellite ground system that provides communications to Navy's surface and submarine forces deployed overseas.⁵⁹

In all there are around 76 separate units located on the base.⁶⁰ These include a helicopter support facility for the S-70B-2 Seahawk anti-submarine warfare helicopters to land and undertake maintenance; Fleet Support Unit-West, which provides general maintenance for submarines, frigates and the replenishment ship; torpedo maintenance facility; underwater tracking range; indoor weapons training system centre; magnetic treatment facility for degaussing (one of only two in Australia); and Navy's second-largest explosive ordnance storage depot.⁶¹

HMAS *Stirling* is an increasingly important training centre for Navy across a number of different areas. It is the site of a seven-story high submarine training escape tower, which is the only one of its kind in the Southern

“HMAS Stirling is an increasingly important training centre for Navy across a number of different areas. It is the site of a seven-story high submarine training escape tower, which is the only one of its kind in the Southern Hemisphere and one of only six in the world.”



Hemisphere and one of only six in the world.⁶² Importantly, HMAS *Stirling* contains the only Submarine Systems Training Centre in the country, which provides basic and advanced instruction for submariners. Including surface fleet training and other programs, in total around 1,200 personnel graduate annually across all the base's training programs.⁶³

The Navy conducts a number of significant exercises in the West, they include EXERCISE OCEAN EXPLORER, which is the largest surface fleet naval exercise in WA, conducted every second year over a four-week period in February/March.⁶⁴ EXERCISE BLACK CARILLION takes place in September every year and is

57 Australian Naval Institute. "Australia's West Coast Navy: the rise of HMAS Stirling". February 27, 2016. Accessed August 30, 2017: <http://navalinstitute.com.au/australias-west-coast-navy-the-rise-of-hmas-stirling/>

58 Personal communication with Captain Brian Delamont, Commanding Officer, HMAS Stirling, June 27, 2017.

59 Australian Naval Institute. "Australia's West Coast Navy: the rise of HMAS Stirling". February 27, 2016.

60 "HMAS Stirling: A Visual Portrayal of Fleet Base West". *Ozbase Magazine*, Issue 1, 2011, p.14.

61 Personal communications with Department of Defence and other sources.

62 Royal Australian Navy. "HMAS Stirling". Accessed August 30, 2017: <http://www.navy.gov.au/establishments/hmas-stirling>

63 Australian Naval Institute. "Australia's West Coast Navy: the rise of HMAS Stirling." February 27, 2016.

64 The aim of the EXERCISE OCEAN EXPLORER is for Navy to conduct high-end task group activities and amphibious operations. The most recent exercise, conducted earlier this year, involved seven frigates from four countries, one auxiliary, two submarine recovery vehicles and the Landing Helicopter Dock, HMAS *Adelaide*. Additional RAAF support included two maritime patrol aircraft and eight FA-18 fast jets.

Navy's only submarine search and rescue exercise. Other submarine-related exercises include EXERCISE PLATYPUS MOON, which is conducted annually in March focussing on swimmer delivery and extraction; and every second year in February and March, EXERCISE LUNGFISH, which is a capability development exercise; and the US Navy-led SUBMARINE COMMAND COURSE, which conducts training of future submarine commanding officers.⁶⁵

The Commonwealth Government has announced its intentions to undertake a series of major upgrades of the base over the years, and decades, ahead. Defence plans to expand the Navy fleet with new acquisitions, namely the size of the submarine fleet from six to 12 vessels, plans to purchase nine new anti-submarine warfare frigates to replace the eight ANZAC Class frigates, and the acquisition and homeporting of a new replenishment ship to supplement the existing oiler HMAS *Sirius*. Although no decisions have been publicly formalised, there is also the distinct possibility that a number of the future Offshore Patrol Vessels (OPVs) will be homeported at HMAS *Stirling*.

With significant increases in future platforms over the next generation there will be a requirement to substantially expand the number personnel at the base. For example, although there has been a 25% increase in base personnel in the last five years,⁶⁶ in order to support the doubling in size of the submarine fleet, an additional 1,000 submarine personnel will be required to be trained at HMAS *Stirling*, with many being permanently based in WA.⁶⁷

With this in mind, Navy's new fleet assets will necessitate an array of new and expanded facilities at HMAS *Stirling*. This includes

expanded wharf facilities, a new fire and damage control centre, and an expanded base operations centre. According to the *2017-18 Defence Portfolio Budget Statements*, the HMAS *Stirling* Redevelopment Stage 3A project received Commonwealth approval in 2016 to spend \$366.8 million on a major upgrade of the base.⁶⁸ This project is one of several planned upgrades of the base by 2025.⁶⁹

“To support the doubling in size of the submarine fleet, an additional 1,000 submarine personnel will be required to be trained at HMAS Stirling, with many being permanently based in WA.”



65 Personal communications with Department of Defence and other sources.

66 Personal communication. Captain Brian Delamont, Commanding Officer, HMAS *Stirling*, June 27, 2017.

67 Personal communication. Captain Brian Delamont, 2017.

68 Department of Defence. *2017-18 Defence Portfolio Budget Statements*. 2017. Accessed October 13, 2017: <http://bit.ly/2zTFure> p. 142.

69 Department of Defence. *2016 Integrated Investment Program*. February 25, 2016. Accessed August 31, 2017: <http://bit.ly/2z0WGMn> pp. 46-47

Table 4: Organisation of HMAS Stirling

Operational	Support	Training
<ul style="list-style-type: none"> • Five Anzac Class Frigates • Six Collins Class submarines • One Auxiliary Replenishment tanker • Clearance Diving Team 4, and Reserve Diving Team 7 	<ul style="list-style-type: none"> • Headquarters elements including HMAS Stirling • Joint Logistics Unit – West • Defence Support Group • Defence Maritime Support • Defence Science and Technology (Maritime Element) • Fleet Support Unit – Perth • Weapons Maintenance and Repair Unit – West • ANZAC Support & Project Office (SPO) • Collins SPO • Afloat and Amphibious Ships SPO • Joint Health Command – West • Port Services Organisation • Helicopter Support Unit 	<ul style="list-style-type: none"> • Training Centre – West • Training Unit ANZAC Systems Centre • Submarine Training and Systems Centre • Navy Technical Training Unit – West • SASR waterborne training element • Naval Aviation Element – RAAF Pearce

Source: HMAS Stirling: A Visual Portrayal of Fleet Base West, *Ozbase Magazine*, Issue 1, 2011, p.12.

2.3 Australian Army

Despite being the largest of the three services, Army has a relatively small presence in WA, coming second to the Navy in size. The elite Special Air Service Regiment (SASR) is a key unit within Special Operations Command (SOCOMD), and is located at Campbell Barracks, Swanbourne. It is the only Australian Regular Army unit based in WA, and the SASR has been referred to as the ‘Jewel in the Australian Defence Crown,’ in terms of ADF capability.⁷⁰ It has a fearsome reputation for being one of the best special forces units in the world, with an unparalleled record of combat experience and success.

The SASR is primarily structured to conduct covert long-range reconnaissance and surveillance in small teams. In addition to warfighting in conflicts, the regiment is also tasked with maintaining a specialist counter-

terrorist capability, with an element of the SASR designated as the Tactical Assault Group (West), perennially on standby to respond to domestic incidents on the west coast of Australia. As a key capability within the ADF, in 2015 Defence authorised the Campbell Barracks Redevelopment Plan, and aims to spend \$223.6 million as part of a major upgrade. The initial works identified in the plan will be completed in early 2018.⁷¹

The 13th Brigade is a reserve formation of the Army’s 2nd Division, and is headquartered at Irwin Barracks, a facility that is expected to undergo a \$100-200 million redevelopment in the years ahead.⁷² 13th Brigade units have their depots spread across metropolitan Perth and regional WA, and there are additional reserve training elements, like the Western Australia University Regiment, which is based at Leeuwien Barracks, Fremantle. Additional tasks include the provision of specialised support capability

70 Personal communication. Former Defence Minister David Johnston, 2017.

71 Department of Defence. “Parliamentary Secretary to the Minister for Defence - New facilities for Special Air Services Regiment in Western Australia a step closer”. June 22, 2015. Accessed August 30, 2017: <http://bit.ly/2iNPWNR>

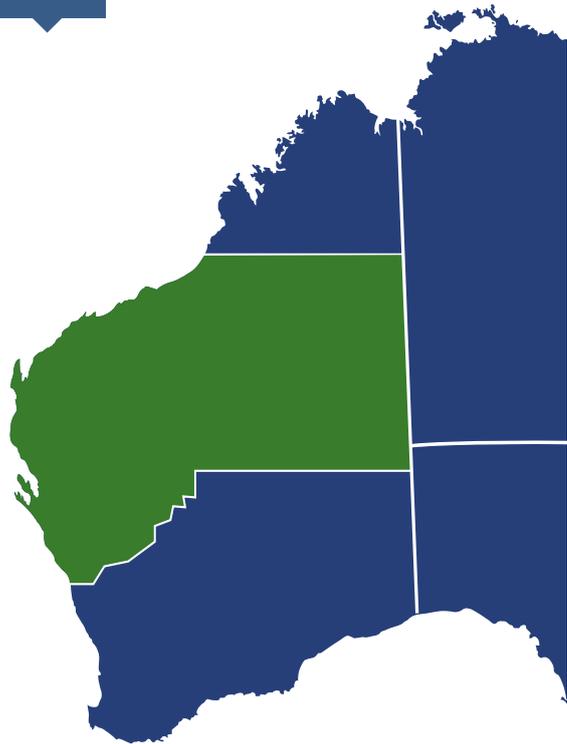
72 Department of Defence. *2016 Integrated Investment Program*. February 25, 2016. Accessed August 31, 2017: <http://bit.ly/2z0WGMn> p.120.

“The SASR has been referred to as the ‘Jewel in the Australian Defence Crown,’ in terms of ADF capability.”



Figure 03

Pilbara Regiment Area of Responsibility



to the Regular Army, the generation of force elements for a battlegroup comprising the 3rd and 11th Brigades, the operation of a Reserve Response Force for domestic disaster relief in WA and interstate, and participation in overseas stabilisation operations. The 13th Brigade incorporates a High Readiness Reserve Combat Team, which can deploy alongside regular Army forces or in support of civilian agencies at short notice.⁷³



The Pilbara Regiment is a specialised unit of around 265 personnel that falls under the command of 6th Brigade.⁷⁴ It is one of the Army’s three Regional Force Surveillance Units (RFSUs), tasked with Intelligence, Surveillance, Target Acquisition and Reconnaissance (ISTAR) operations in support of OPERATION RESOLUTE, Defence’s contribution to patrolling Australia’s northern exclusive economic zone. The Pilbara Regiment is responsible for monitoring 1.3 million km² of north and central WA,⁷⁵ and is headquartered at Taylor Barracks, at Karratha, with depots in the State’s centre, at Tom Price, Exmouth, Port Hedland, Newman, Carnarvon and Perth. The third Army Reserve unit in WA is the Kimberley Squadron of the North-West Mobile Force (NORFORCE), another RFSU affiliated with the 6th Brigade, which is headquartered at Broome and maintains depots in Derby and Kununurra.

73 The 13th Brigade is composed of around 100 Regular Army personnel. For further information on the composition of the formation see Sutton, Mitchell and DeSilva-Ranasinghe, Serge. “Let Difficulties Not Deter: The Army Reserve’s 13th Brigade – Interview with Brigadier Stephen Coggin CSC”. *The Australian Reservist*. Issue 22. April 2014. Accessed September 28, 2017: <http://bit.ly/2z5MhAW> pp. 20-24.
 74 Australian Army. “Pilbara Regiment”. September 13, 2016. Accessed October 6, 2017: <http://bit.ly/2z4cYWF>
 75 Australian Army. “Pilbara Regiment”. September 13, 2016.

Table 5: Organisation of the Army in Western Australia

Unit	Functionality	Location	State Electorate	Federal Electorate
Special Air Service Regiment	Campbell Barracks is the headquarters and home base of the SASR, and other supporting elements from Special Operations Command (SOCOMD).	City of Nedlands	Cottesloe	Curtin
13th Brigade <ul style="list-style-type: none"> • WA University Regiment • A Squadron, 10th Light Horse Regiment • 3rd Light Battery, Royal Australian Artillery • 13th Field Squadron, Royal Australian Engineers • 109th Signals Squadron • 11/28th Battalion RWAR • 13th Combat Services Support Battalion • 7th Field Ambulance • 10th Transport Squadron • 13th Field Supply Company • 5th Dental Unit • 13th Field Workshop Company 	Irwin Barracks is the home of the Army Reserve in WA and is where most 13th Brigade units are presently based.	City of Nedlands	Cottesloe	Curtin
16th Battalion RWAR	Leeuwin Barracks primarily houses Defence public servants, but acts as a training base for the WA University Regiment. Defence has announced that it intends to decommission and sell the base in the near future.	City of Fremantle	Nedlands	Fremantle
Pilbara Regiment	<p>Taylor Barracks is the home base for the Pilbara Regiment and the only RFSU barracks in the West.</p> <p>The Pilbara Regiment's 3rd Squadron, often referred within the unit as the 'FIFO squadron', is based at Irwin Barracks. It serves as a useful manpower reserve to supplement its profile throughout the North West.</p> <p>Depots:</p> <ul style="list-style-type: none"> • Carnarvon • Exmouth • Irwin Barracks • Karrakatta • Newman • Port Hedland • Tom Price 	City of Karratha	Pilbara	Durak
Kimberley Squadron, NOFORCE	<p>Depots:</p> <ul style="list-style-type: none"> • Broome • Derby • Kununurra 	Shires of Derby-West Kimberley and Wyndham-East Kimberley	Kimberley	Durack

2.4 Royal Australian Air Force

The Royal Australian Air Force (RAAF) in WA operates permanently out of RAAF Pearce, located at Bullsbrook, in outer metropolitan Perth. It is the primary Air Force base for military operations in WA, with an emphasis on maritime patrol operations, and search and rescue operations across the southern Indian Ocean and Southern Ocean, and potentially Antarctica, as well as the Australian territories of Heard and McDonald Islands, which are 4,000km off Cape Leeuwin.

RAAF Pearce is the busiest Air Force base in the country with an estimated 110,000 aircraft movements annually.⁷⁶ The base is primarily used as a training facility, as well as a stopover point for air patrols over the Indian Ocean and aircraft departing for the Middle East. It is home to No. 2 Flying Training School equipped with PC-9A turboprop trainer aircraft, No. 79 Squadron with Hawk 127 jet trainer aircraft.

RAAF Pearce is supported by No. 25 (City of Perth Squadron), which coordinates maintenance, command and control, logistics and base amenities via contractors. Other units stationed at the base tend to be detachments from specialised formations based in the east, such as No. 2 Expeditionary Health Squadron; No. 453 Squadron, which provides air traffic control functions; and No. 3 Security Force Squadron, which provides base security in conjunction with a civilian contractor. The *2016 Defence White Paper* also committed large-scale investment in Air Force facilities in WA. RAAF Pearce will receive \$30 million in funding to redevelop existing assets.⁷⁷ Work at RAAF Pearce will facilitate the operation of the new Boeing P-8A Poseidon maritime surveillance aircraft, to replace the retiring P-3 Orion.

“RAAF Pearce is the busiest Air Force base in the country with an estimated 110,000 aircraft movements annually.”



The aircraft at RAAF Pearce reflect its aviation training role, including Hawk 127 lead-in fighter trainer aircraft and PC-9/A advanced undergraduate trainer aircraft. These units are currently changing their training curricula, with live training increasingly being supplemented by simulators. RAAF Pearce has also been used as a transit point to the Middle East Area of Operations (MEAO), and was one of the main bases, along with Perth International Airport, used for the multinational air operation in search of the missing Malaysian Airlines aircraft, MH370 in 2014-15, known as Operation Southern Indian Ocean. After MH370 went missing in the region, up to 10 wide-bodied aircraft from China, Japan, Korea, Malaysia, New Zealand and the US all operated from the base.⁷⁸

The base facilitates military operations throughout the State and overseas and aircrew training facility for Air Force and Navy. The SASR uses RAAF Pearce to conduct parachuting, equipment drops and close air support activities throughout the year. RAAF Pearce provides a total of 15 weeks annual support of Army exercises such as EXERCISES PEGASUS MOON, EMU MOON, IRON EAGLE and PHOENIX BLACK, with each exercise

76 DeSilva-Ranasinghe, Serge and Sutton, Mitchell. “RAAF Base Pearce will remain the primary base in the West.” *Contact Air, Land and Sea*. Issue 48. December 2015. Accessed September 28, 2017: <https://issuu.com/contactpublishing/docs/contact48/60> pp. 60-64.

77 Turner, Rebecca. “WA defence capabilities to get \$4b upgrades under White Paper Plan”. *ABC News*, February 26, 2016. Accessed August 31, 2017. <http://ab.co/2gPn978>

78 Department of Defence. “Defence involved in search for MH370”. Accessed October 13, 2017: <http://bit.ly/2A340qW>

approximately two weeks in duration. RAAF Pearce also annually hosts the 6th Aviation Regiment, which is based at Holsworthy, NSW, for EXERCISE IRON ROTOR.⁷⁹

Other air bases in the State include RAAF Gingin, which is a small satellite airfield close to RAAF Pearce also used for pilot training; and the two bare bases in the North West, RAAF Curtin and RAAF Learmonth, are maintained at minimal capacity to be activated in case of emergencies, training exercises or air movements. The bare bases are often utilised for training by the RAAF Pearce-based units, as well as supplying aircraft bound for the MEAO and AP-3C patrols.⁸⁰ Unlike RAAF Curtin, the base at RAAF Learmonth is in frequent use as a strategic hub for AP-3Cs operating over the Indian Ocean.

As part of its infrastructure modernisation plan, Defence has announced that RAAF Curtin will receive a massive redevelopment

investment of between \$100-200 million from 2017-22 to support Australia's new fleet of Joint Strike Fighter (JSF) aircraft.⁸¹ This is on top of \$2.3 million of existing capital works for the airfield currently being carried out. In addition, RAAF Learmonth will have \$190 million invested over the next decade to boost the capacities of Air Force facilities in Northern Australia,⁸² also enabling JSF usage. Upgrades at both bases will include additional air traffic control infrastructure and improved firefighting and refuelling facilities.

WA is also host to several arrangements with foreign military contingents. The Republic of Singapore (RSAF) Air Force's No. 130 Squadron and Flight Training School is based out of RAAF Pearce, and utilises PC-21 aircraft for training purposes. As Singapore is a member of the Five Power Defence Arrangements, Australia has allowed the RSAF to use WA since 1993, and allows Singapore to maintain and operate a Flying Training Institute at the base. It is



Photo courtesy of Department of Defence

79 Personal communications with Department of Defence and other sources.

80 Personal communications with Department of Defence and other sources.

81 Department of Defence. *2016 Defence Integrated Investment Program*. 2016. Accessed September 28, 2016: <http://bit.ly/2iheoDj> p .102.

82 Turner, Rebecca. "WA defence capabilities to get \$4b upgrades under White Paper Plan." 2016.

notable that RSAF training activity at RAAF Pearce accounts for around half of the base’s aircraft movements annually.⁸³ At a recent meeting this year, the Commonwealth Government agreed to extend Singapore’s presence at RAAF Pearce for another 25 years.⁸⁴

Table 6: Organisation of the Royal Australian Air Force in Western Australia

Facility	Functionality	Units	Local Government Area	State Electorate	Federal Electorate
1. RAAF Pearce	WA’s largest airbase primarily utilised for intermediate pilot training on turboprop aircraft, as well as initial fast-jet courses for more advanced students. The Republic of Singapore Air Force also utilises the base as a training facility.	<ul style="list-style-type: none"> • Combat Support Group, 96 Wing. • No. 1 Airfield Operations Support Squadron Detachment Pearce • No. 1 Expeditionary Health Squadron Detachment Pearce • No. 2 Flying Training School • No. 25 (City of Perth) Squadron • No. 3 Security Force Squadron Detachment • No. 453 Squadron Pearce Flight • No. 79 Squadron 	City of Swan	Swan Hill	Pearce
2. RAAF Gingin	A small airfield utilised for flight training. Not permanently staffed.	n/a	Shire of Gingin	Moore	Pearce
3. RAAF Learmonth	Situated at Exmouth on the strategic North West Cape of Australia, RAAF Learmonth has a small cohort of permanent caretaker staff, and is capable of being brought up to full operational capacity at short notice.	n/a	Shire of Exmouth	North West Central	Durack
4. RAAF Curtin	Located in the remote Kimberley district, RAAF Curtin is another bare base managed by a small contingent of permanent caretaker staff. However, at short notice it is capable of being brought up to full operational capacity.	n/a	Shire of Derby-West Kimberley	Kimberley	Durack

83 Personal communications with Department of Defence and other sources.

84 Fai Kok, Loke. “25 more years of flying out of Australia’s Pearce Air Base for RSAF pilots”. *Channel News Asia*. August 21, 2017. Accessed September 28, 2017: <http://bit.ly/2xC8B1E>

2.5 Defence Training Areas

The Department of Defence has a number of dedicated training areas throughout WA which are utilised by the ADF for a variety of purposes and activities.

Table 7: Defence Training Areas in Western Australia

Name	Functionality	Local Government Areas	State Electorate	Federal Electorate
1. West Australian Exercise Area and Underwater Tracking Range (WAXA)	Situated west of HMAS Stirling, the WAXA covers an estimated 21,200 square nautical miles and is used extensively by Navy to undertake both naval and maritime aviation training exercises.	Indian Ocean	n/a	n/a
2. Lancelin Training Area	Located 140km north of Perth, and covering a 13,000ha site, the Lancelin Training Area is used extensively by Army, Navy and Air Force to conduct live fire exercises. Army use it to conduct weapons qualifications courses, driver courses, tactical and explosive ordnance demolition training. It is large enough for Army units up to the size of battalion to engage in manoeuvre exercises. It is the only live-fire naval gunnery range in WA, and is only one of two such ranges in Australia. The Air Force also uses it for air to ground weapons training with inert and high explosive weapons.	Shire of Gingin	Moore	Pearce
3. Bindoon Training Area	Located 93km north of Perth, and covering a 19,546ha site, the Bindoon Training Area is the most heavily used and important live-firing range and training area in WA. It is engaged for a variety of training purposes such as small arms, navigation, special forces, explosives and counter-terrorism training. Bindoon also hosts Defence's most advanced urban warfare training facility, comparable in size to that of Holsworthy in NSW, and has an array of other training environments which are used by Army.	Shire of Chittering	Moore	Pearce
4. Northam Training Area	Located 96km east of Perth, the 200ha Northam Training Area is used for vehicle driver training, emergency services training, storage and logistics support and cadet training activities.	Shire of Northam	Central Wheatbelt	Pearce
5. Bullsbrook Training Area	The training area of Bullsbrook is around 1000ha in size and is used by the 13th Brigade for low-level off-road driver and engineer training.	City of Swan	Swan Hills	Pearce

6. Learmonth Air Weapons Range	Located in the Pilbara hinterland south-east of RAAF Learmonth, the 18,700ha Learmonth Air Weapons Range is utilised for high explosive bombing, rocketry, air to ground gunnery, radar bombing and small arms practice.	Shire of Exmouth	North West Central	Durack
7. Muchea Air Weapons Range	Utilised for the training of aircrew instructors, air to ground gunnery, driver training, and field and small arms training.	Shire of Chittering	Moore	Pearce
8. Yampi Sound Training Area	Located in the isolated and rugged Kimberley region, and 130km northwest of Derby, the 550,000ha Yampi Sound Training Area is one of the largest training areas owned by Defence. It is used periodically by SOCOMD and Kimberley Squadron of NORFORCE. In 2017, Defence announced plans to improve access and training facilities by 2020, commencing with a new high-explosive impact area. This will include practical upgrades such as waste disposal facilities through to capability improvements such as modern target simulation equipment.	Shire of Derby-West Kimberley	Kimberley	Durack



Photo courtesy of Department of Defence

Figure 04

Significant ADF Facilities and Training Areas

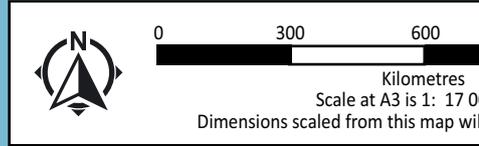
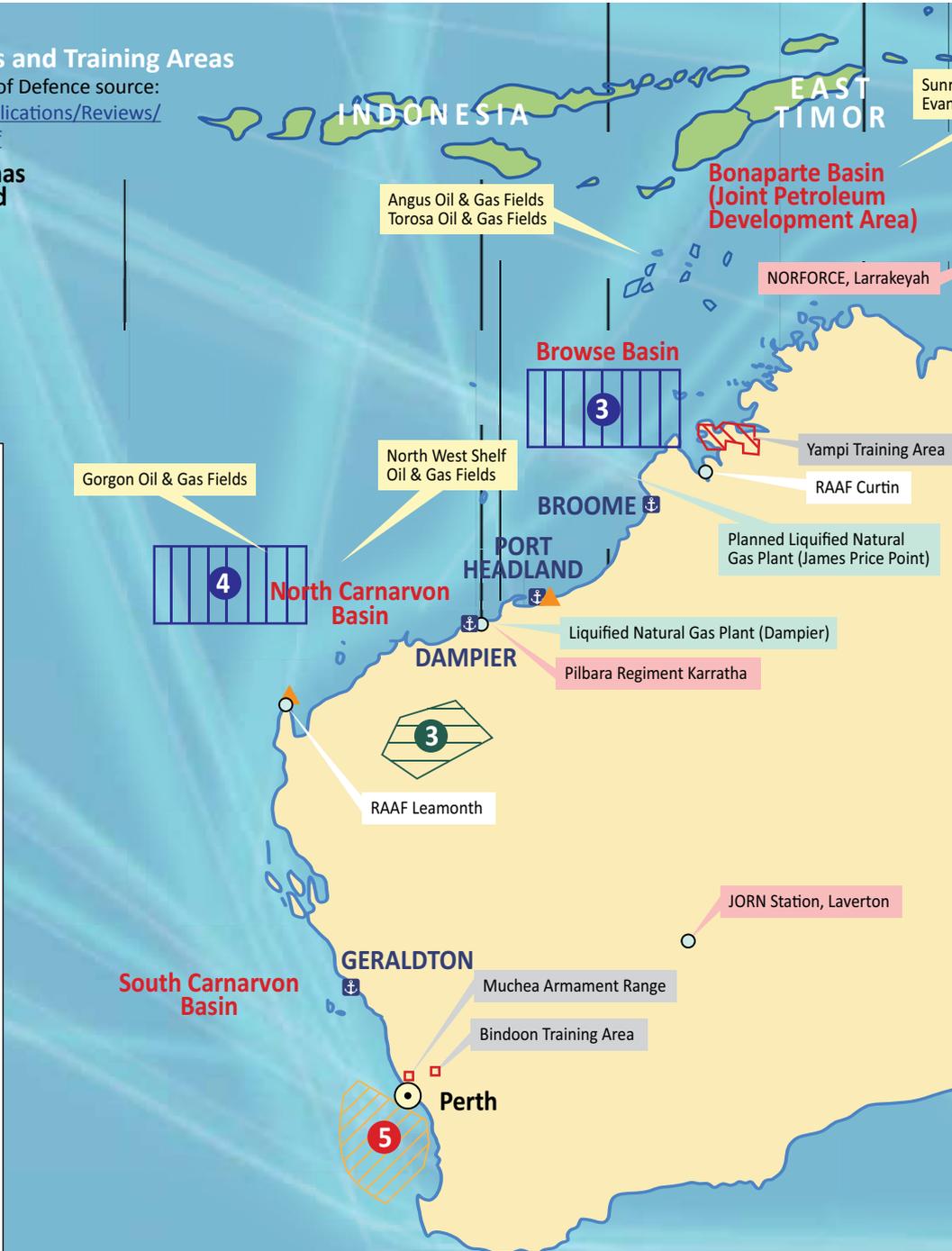
On-line reference: Department of Defence source: http://www.defence.gov.au/Publications/Reviews/ADFPoSture/docs/base_map.pdf

- Capital City Bases and Significant ADF Facilities**
- Adelaide**
 Edinburgh Defence Precinct
 Elizabeth North Training Depot
 Keswick Barracks
 Hampstead Barracks
 Warradale Barracks
 Woodside Barracks
- Brisbane**
 Bulimba Barracks
 Gallipoli Barracks, Enoggera
 RAAF Amberley
 Victoria Barracks, Brisbane
- Canberra**
 Australian Defence Force Academy (ADFA)
 Canberra Offices (leased)
 Headquarters Joint Operations Centre, Bungendore
 HMAS Harman
 RMC Duntroon
 Russell Offices
- Darwin**
 Defence Establishment Berrimah
 HMAS Coonawarra
 Larrakeyah Barracks
 RAAF Darwin
 Robertson Barracks
- Hobart**
 Anglesea Barracks
 Derwent Barracks, Glenorchy
- Melbourne**
 DSTO, Fishermans Bend
 Fort Queenscliff, Melbourne
 HMAS Cerberus
 RAAF Williams (Laverton)
 RAAF Williams (Point Cook)
 Simpson Barracks, Watsonia
 Victoria Barracks, Melbourne
- Perth**
 Campbell Barracks, Swanbourne
 HMAS Stirling
 Irwin Barracks, Karrakatta
 Leeuwin Barracks, Fremantle
 RAAF Pearce
- Sydney**
 Defence Establishment Orchard Hills
 Garden Island (Fleet Base East)
 HMAS Penguin, Sydney
 HMAS Waterhen
 HMAS Watson
 Holsworthy Barracks, Liverpool Military Area
 Randwick Barracks
 Steele Barracks, Moorebank
 Timor Barracks, Dundas
 Victoria Barracks, Sydney

- Air Weapons ranges**
 1: Halifax Bay
 2: Delamere
 3: Learmonth

- Air-to-Air Air Weapons Ranges**
 1: Townsville
 2: Darwin
 3: Curtin
 4: Learmonth

- Off-shore Training Areas**
 1: North Australian Exercise Area (NAXA)
 2: East Australian Exercise Area (EAXA)
 3: West Head Gunnery Range
 4: South Australian Exercise Area (SAXA)
 5: West Australian Exercise Area (WAXA) and Underwater Tracking Range



UNCLASSIFIED

ADF Base or Significant Facility	Oil & Gas-related Facility	Capital Cities	Shipping Lane	ADF Training Areas
Other Defence Site	Oil & Gas Field	ADF Facility	RFSU Depot/ Patrol Base	Offshore Training Areas
ADF Training Area		Civil Port		

Air-to-Air Weapons Ranges and Air Weapons Ranges are indicative only



- Air-to-Air Weapons Ranges
- Air Weapons Ranges

AUSTRALIA

SIGNIFICANT ADF FACILITIES, ADF TRAINING AREAS, SELECTED CIVIL PORTS and OFFSHORE RESOURCES

This map is for orientation and briefing purposes only and should not be used for targeting or navigation. Political boundaries and place names are not necessarily authoritative.

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Section 3

Capabilities of Defence Industry

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Section 3:

Capabilities of Defence Industry

The composition of WA's defence industry is largely reflective of the Defence installations and capabilities in the State, which are, by and large, centred around metropolitan Perth. What is also notable is the overwhelmingly dominant profile of the naval and maritime sector, which is located at, or near, the Australian Marine Complex (AMC) at Henderson. Yet, defence industry in WA actually has a diverse profile spanning other areas emphasising aviation sustainment, Army and land, Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR), logistics, estate and infrastructure, university and tertiary institutions, and an array of innovative miscellaneous firms that provide niche capabilities to Defence.

Whilst dominated by numerous international Defence primes, defence industry in WA sustains a large number of SMEs whose capabilities are recognised nationally, and in some cases, internationally. As affirmed by the WA Minister for Defence Issues, Paul Papalia: "Western Australia has an unparalleled shipbuilding capability, and the greatest concentration of defence-related prime contractors and small to medium enterprises of any capital in the nation".⁸⁵ Similarly, speaking on this matter to the Senate in November 2016, Senator for Western Australia, Linda Reynolds, stated:

“Companies that are either based or operate in WA represents approximately 6% of Defence SMEs nationally, and 16% of the national defence industry workforce.”



Our steel fabrication capability is the largest in Australia ... We also have the most experienced and largest manufacturing workforce... WA is also home to Australia's largest marine complex in Henderson ... The innovation that has driven the oil and gas sector, that has driven the iron ore industry, and has overseen decades of state and nation-building, is now being directed in WA to building our defence industries.⁸⁶

Defence industry nationally comprises 3,000 SMEs and the total workforce encompassing Defence primes and SMEs employs around 25,000 people.⁸⁷ Companies that are either based or operate in WA represents approximately 6% of Defence SMEs nationally, and 16% of the national defence industry workforce. It is estimated that there around 180 companies or their immediate sub-contractors directly supporting Defence materiel acquisition and sustainment in WA, and they provide

85 McMahon, Amelia. "WA to expand local defence industry with ambitious plans". May 22, 2017. Accessed October 16, 2017: <http://bit.ly/2hnlhDn>

86 Senator Linda Reynolds, "WA's Defence Industry", YouTube, November 17, 2016. Accessed November 15, 2017: <https://youtu.be/71gc0hATpvE> (viewed at timecodes 3.20, 4.40, 5.12, 6.17).

87 Senator Linda Reynolds, "WA's Defence Industry", YouTube, November 17, 2016. Accessed November 15, 2017: <https://youtu.be/71gc0hATpvE> (viewed at timecodes 3.20, 4.40, 5.12, 6.17).

employment to around 3,000-4,000 people.⁸⁸ In FY2015-16, Defence estimated that the total work value in WA for major materiel acquisition and sustainment amounted to \$700 million, and which equated to 10.4% of total forecast Defence expenditure.⁸⁹

3.1 Defence Industry Peak Bodies

Defence industry in WA is represented by one state government agency, and five industry bodies, that all advocate for the interests of the defence sector. The key organisations include the Office of Defence West, the Australian Industry and Defence Network of WA (AIDN-WA), the Chamber of Commerce and Industry WA (CCIWA), the Australian Industry Group (AiGroup), the Australian Society for Defence Engineering (ASDE), and the Henderson Alliance.

The profile of the WA defence industry is currently at a historic high point since the WA Government appointed Paul Papalia, as the State's Minister for Defence Issues earlier this year. This is the first time a WA Minister has formally had Defence as part of ministry title since 1983 when former Deputy Premier Mal Bryce was appointed Minister for Industrial Development, Technology and Defence Liaison.⁹⁰ Furthermore, in May this year the WA Government launched the Office of Defence West, which is responsible for promoting the interests of defence industry in WA, and to assist in securing more defence-related work.⁹¹

More recently, in another unprecedented announcement the WA Government appointed

former Lockheed Martin Australia CEO, and Rear Admiral Raydon Gates as the Defence Advocate for WA in Canberra, to strengthen WA's advocacy profile and influence at the national level.⁹² The combined implementation of these measures has markedly strengthened the profile of defence industry in WA, and is likely to provide more outcomes for the sector's future advancement. For instance, the Office of Defence West has indicated that it will appoint a defence industry advisory board to provide high-level strategy and policy advice to the WA Government. The Office shall also launch a biennial Indian Ocean defence trade show in WA in 2019 to showcase the capabilities of local industry.⁹³ Commenting on the rationale behind the initiative the Minister for Defence Issues explained: "We'll also be moving to establish a biennial expo here in Western Australia for the Indian Ocean region, to replicate one that's done in Sydney for the Pacific region."⁹⁴

Among the States Defence peak bodies, the AIDN-WA is a long-standing defence industry body that has been at the forefront of advocating for the interests of local defence industry. As a national organisation with over 600 member companies,⁹⁵ its WA chapter has a membership base of over 70 companies and includes most Defence primes operating in the State. AIDN-WA makes representations to political and government figures on behalf of industry, to encourage policies that promote defence industry growth. As part of its advocacy work, AIDN-WA authors submissions to Commonwealth *Defence White Papers* on matters affecting its WA members and hosts

88 Personal communications with Department of Defence and other sources. Note, the term 'defence industry' is used to encompass enterprises across all categories and sectors that do business with Defence, either directly or through other contractors. While some products and services certainly relate to weapons systems and platforms such as ships and planes, most consist of ordinary items vital to the life of any community.

89 Personal communications with Department of Defence and other sources.

90 State Library of Western Australia. "Bryce, Malcolm John". Accessed October 13, 2017: http://slwa.wa.gov.au/pdf/mn/mn2501_3000/mn2950.pdf. p.1.

91 Defence West. "Defence West to champion interests of the industry and create jobs". May 26, 2017. Accessed September 29, 2017: <http://bit.ly/2gNa1Q6>

92 "Defence West to champion interests of the industry and create jobs". May 26, 2017.

93 WA Labor. "Defence West to Drive Investment in the Local Industry". April 2016. Accessed September 29, 2017: https://www.markmcgowan.com.au/files/Defence_West.pdf

94 McMahon, Amelia. "WA to expand local defence industry with ambitious plans". 2017.

95 Australian Industry and Defence Network. "Welcome to the Australian Industry and Defence Network". 2017. Accessed October 8, 2017: <http://www.aidn.org.au/>

a number of events each year that showcase defence industry to government and encourage intra-industry partnerships.⁹⁶

In recent years, the CCIWA formed a defence industry council to advocate for the interests of local defence industry. The council has undertaken a trade mission to Europe to promote WA's capability, prepares submissions on behalf of defence industry, and holds an annual WA defence industry conference, now in its second year.⁹⁷

Although a leading national industry association, the AiGroup is a recent entrant to the WA defence scene. The AiGroup has for many years maintained an east coast-based defence council to advise its members, and both Commonwealth and state governments, on policy issues affecting defence industry. The activities of this council are guided by the AiGroup national executive, which comprises CEOs of Australia's key defence companies.⁹⁸

The ASDE is the professional body for licenced engineers in the defence industry. As a branch of Engineering Australia, it has input in the regulation of Defence engineers as well as advocating on behalf of their members who work in the defence sector. ASDE aims to foster the exchange of information relating to the theory and practice of defence engineering.⁹⁹

The Henderson Alliance is an industry group formed in early 2017. Its aims are to develop collaboration between Henderson-based SMEs to collectively bid for Defence contracts. It is principally focussed on the naval and maritime sector around the Australian Marine Complex (AMC) in Henderson.¹⁰⁰

3.2 Naval and Maritime

As the largest component of defence industry in WA, the naval and marine sector involves a wide array of activities, ranging from shipbuilding to marine services. The marine sector has expanded dramatically since the announcement of the Two Ocean Navy policy, the resources sector boom, and the establishment in 2003 of the AMC in Henderson, which is owned by the WA Government and is operated and managed by AMC Management.¹⁰¹ Given the consistency in shipbuilding excellence at Henderson, Defence has identified it as one of two centres of shipbuilding in Australia to orchestrate elements of its continuous build program.

Since its foundation, the AMC has emerged as a national and internationally recognised centre of excellence for manufacturing, fabrication, assembly, maintenance and technology development, servicing the marine, defence, mining, oil and gas sectors. There are over 150 businesses that are situated in the AMC, and it is sub-divided into four precincts; maritime, technology, support industry and fabrication. In addition, the AMC has four multi-user facilities that include the Common User Facility (CUF), AMC Jakovich Centre, ACEPT Training Facility and Marine Support Facility.¹⁰² Of centrality to the AMC is the Common User Facility, which is replete with a deep-water harbour, five wharves, a floating dock (the largest in Australia), and a fabrication hall. It has the capacity to berth vessels up to 300m in length along the wharves, and can also provide for sufficient berthing space to undertake significant projects such as ship conversions, refits and repairs.¹⁰³

96 AIDN-WA. "Australian Industry and Defence Network Western Australia". Accessed September 29, 2017: <http://www.aidn-wa.org.au/>; AIDN. "Welcome to Australian Industry and Defence Network". Accessed September 29, 2017: <http://www.aidn.org.au/>

97 Chamber of Commerce and Industry WA. "WA Defence Industry Council". Accessed September 29, 2017: <http://bit.ly/2ltPqVY>

98 Australian Industry Group. "New Head – Defence & Industry Policy at Australian Industry Group". Accessed September 30, 2017: <http://bit.ly/2ih3FIY>

99 Australian Society for Defence Engineering. "Engineers Australia – Australia's preeminent engineering body". Accessed September 29, 2017: <https://www.engineersaustralia.org.au/About-Us>

100 Henderson Alliance. "Welcome to Henderson Alliance". Accessed September 29, 2017: <http://www.hendersonalliance.com.au/>

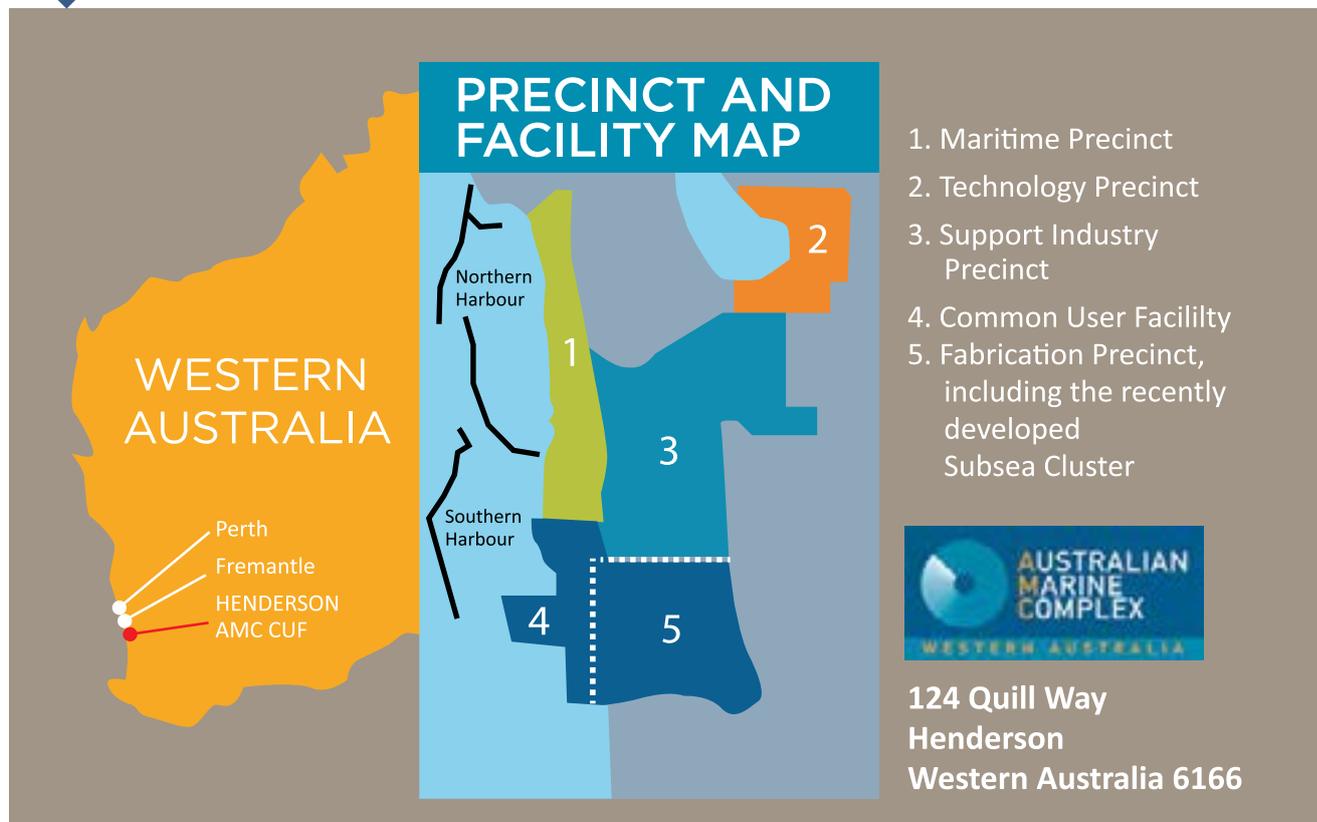
101 "Gold Sponsor Interview – AMC Management". *WA Defence Review TV*. July 24, 2017. Accessed September 29, 2017: <https://www.youtube.com/watch?v=XvUTEzXDpJg>

102 Australian Marine Complex. "About the AMC". 2010. Accessed September 29, 2017: <http://bit.ly/2hrndee>

103 Australian Marine Complex. "AMC+Defence". 2010. Accessed September 29, 2017: <http://bit.ly/2hp2EPH>

Figure
05

Map of the Australian Marine Complex



Source: AMC Common User Facility Publication.

The profile of defence industry at the AMC has grown markedly since its inception and now hosts, according to the Henderson Alliance, a combined total of nearly 40 Defence primes, significant suppliers, and numerous SMEs that are active in supporting Defence. As Figure 6 indicates, the use of the AMC CUF by Defence, and defence industry, has markedly increased since the construction of a 99m x 53m floating dock with a 44m internal width, which is capable of lifting 12,000 tons, and has the ability to transfer vessels of 3,500 tons to shore.¹⁰⁴

The floating dock integrates with self-propelled modular transporters to transfer vessels, such as Navy's Collins Class submarines, ANZAC frigates and other heavy modules from water to land (see Figure 7).¹⁰⁵ The concept of a second stage to the floating dock (see Figure 8), although yet to be funded, that will be a detachable addition will expand the total length of the floating dock to 232m,¹⁰⁶ giving it a 28,000 ton lift capacity that can accommodate new warships such as 147.2m Hobart Class Air Warfare Destroyer and the 230.8m Canberra Class LHD.¹⁰⁷

104 Australian Marine Complex. "About the AMC." 2010 ; Australian Marine Complex. "New Floating Dock a world first". 2010. Accessed September 29, 2017 :http://www.australianmarinecomplex.com.au/News/?news_id=17864

105 Australian Marine Complex. "AMC+Defence". 2010.

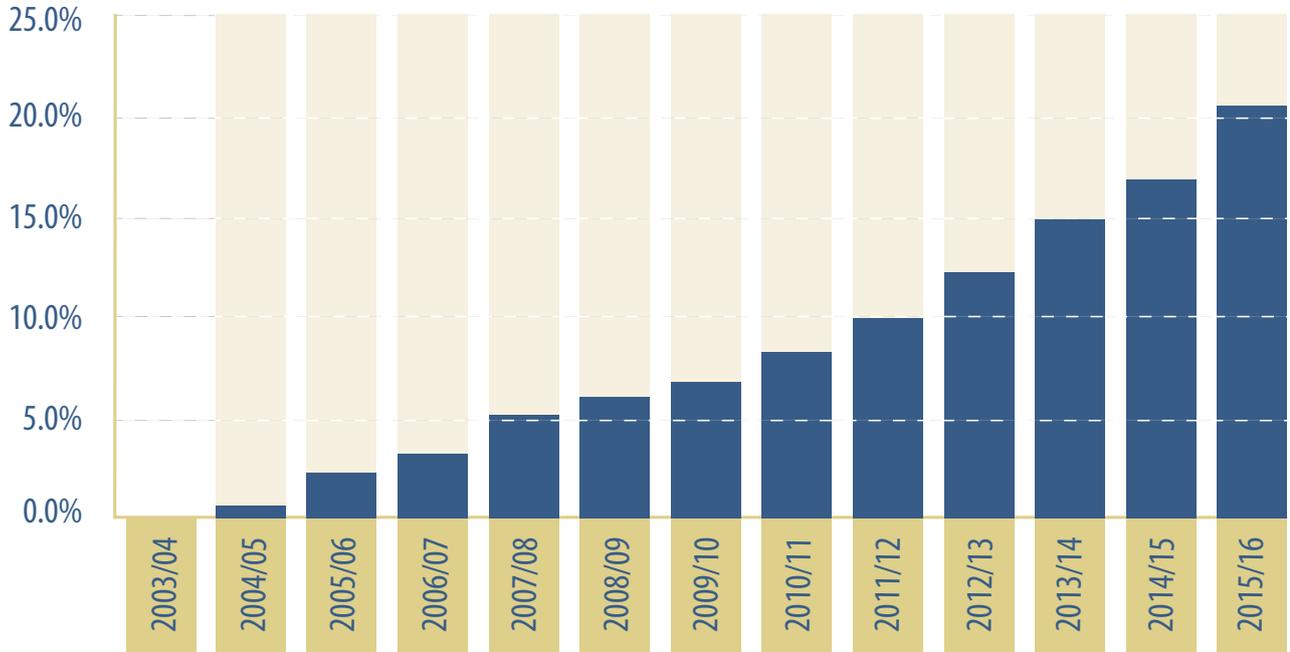
106 Australian Marine Complex. "Special feature: Australian Marine Complex floating dock is ready!" *The AMC News*. No.11. February 2010. Accessed September 29, 2017: <http://bit.ly/2z0ClZG>. pp.8-11.

107 Royal Australian Navy. "Size Comparison LHD-AWD-FFG-FFH. Accessed September 29, 2017: <http://bit.ly/2zIz82l>

Figure 06

Percentage of AMC CUF Utilisation for Defence-Related Projects Since FY2003-04

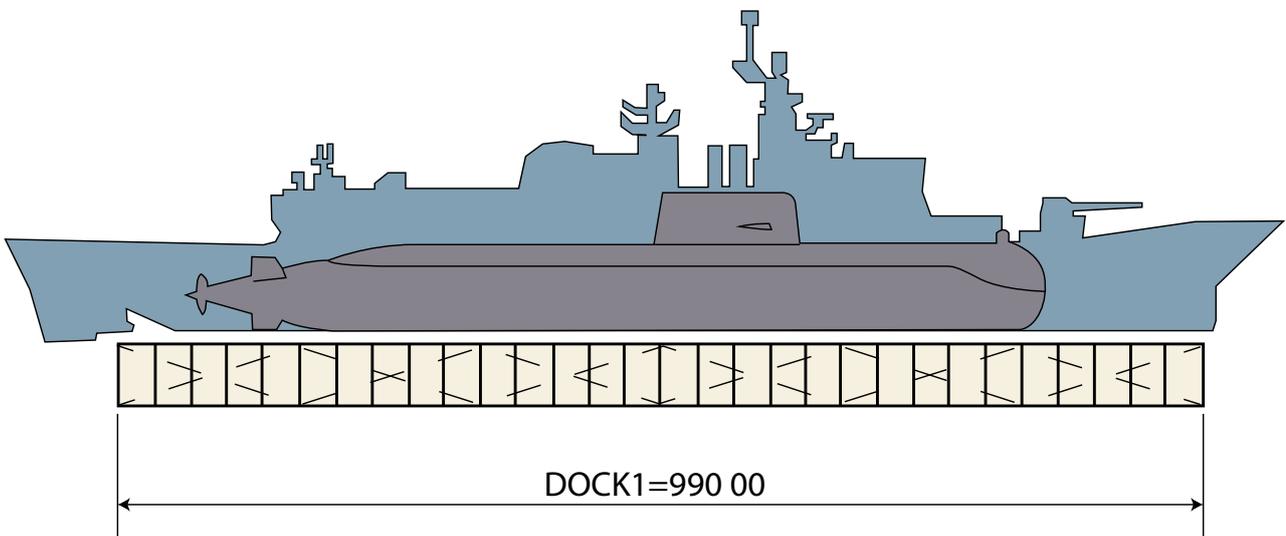
Defence Utilisation of the AMC CUF



Source: AMC Common User Facility Presentation

Figure 07

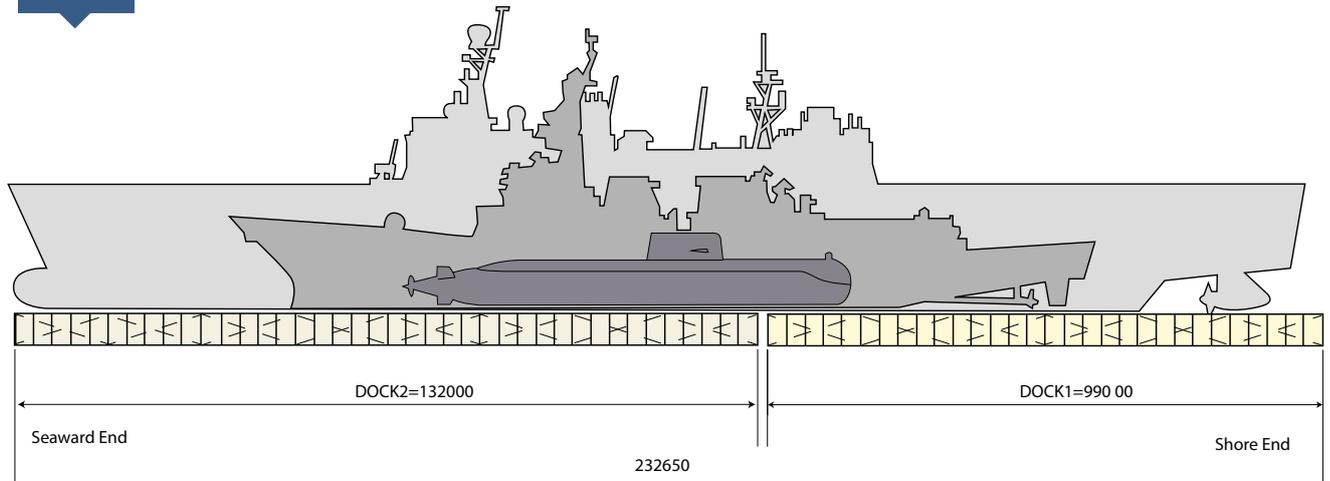
Existing Size and Capability of the AMC Floating Dock



Source: AMC Common User Facility Presentation.

Figure 08

Figure 8: Concept Phase Two Expansion of Floating Dock Facility



Source: AMC Common User Facility Presentation.

Table 8: Defence Primes in the WA Naval & Maritime Sector

<p>ASC</p>	<p>ASC is the prime contractor overseeing the sustainment of the Collins Class submarine platform systems. The WA facility is located at Henderson, known as ASC West, and is where Mid Cycle and Intermediate Dockings of submarines are conducted. ASC West also has a contract with the Navy to provide initial and advanced submarine training at HMAS Stirling’s Submarine Training Systems Centre. As the commencement of the naval build program in South Australia gains impetus, although no announcements have been made as of yet, there is a distinct future possibility that all Full Cycle Dockings that are currently done at Osborne, could be shifted to Henderson.</p>
<p>Austal</p>	<p>Austal is Australia’s only ASX-listed shipbuilder and global defence Prime contractor, established and headquartered in WA since 1988. Initially concentrating on the international high-speed aluminium ferry market, the company has grown to become the world’s largest aluminium shipbuilder and Australia’s largest defence exporter.</p> <p>Austal has delivered and/or has under construction over 300 vessels, for more than 100 operators in 54 countries. In Australia, Austal has been the sole supplier of border patrol capability to the Commonwealth, delivering 32 vessels to the Royal Australian Navy and Australian Border Force since 1998.</p> <p>The company employs over 5,000 people at five shipyards worldwide, including: Henderson Naval Base in WA, Mobile Alabama in the US, Balamban in Cebu, the Philippines and Guangdong Province in China (Aulong joint venture with Jianglong Shipbuilding). Austal also provides vessel sustainment and in-service support to customers through a growing network of service centres located in Australia, the US, the Philippines, Singapore and the Middle East.</p> <p>Austal is currently contracted to design, construct and sustain 19 x 39.5 metre steel hull Pacific Patrol Boat Replacement vessels to 12 Pacific countries from 2018. Austal recently delivered two additional 58 metre Cape Class Patrol Boats to the Royal Australian Navy, following the completion of eight Cape Class boats for the Australian Border Force over 2013-15. Austal is also providing support to CN09 through the Armidale Class Patrol Boat hull remediation program, which is scheduled for completion in early 2018.</p>

Babcock	<p>Babcock is a supplier of key systems on the Collins Class submarine including the Weapons Launch System and Submerged Signal Ejectors. It operates from an engineering and maintenance facility in Henderson. Babcock also provides long term maintenance support services for the ANZAC Class ships, also in Henderson, as part of a joint venture with UGL Limited called Naval Ship Management (Australia) Pty Ltd.</p>
BAE Systems Australia	<p>BAE Systems Australia has over 500 employees at its Henderson facility where it conducts substantial sustainment and capability work on the ANZAC Class Frigates, including manufacturing and installing new masts for the vessels under the Anti-Ship Missile Defence (ASMD) Upgrade Program and the new SEA1448 Long Search Radar replacement Project.</p> <p>BAE Systems is also contracted to provide:</p> <ul style="list-style-type: none"> • Repair and re-certify submarine periscopes and support submarine activities as required at HMAS Stirling. • Sustainment of the Royal Australian Navy ANZAC Class Frigates for the following activities: <ul style="list-style-type: none"> a. Docking Selected Restricted Availabilities; b. Intermediate Maintenance Availabilities; c. Selected Restricted Availability; d. Maintenance Window of Opportunity; e. Defect Rectification Periods; f. Urgent Defects; g. Physical Condition Assessments; h. Major and Minor Engineering Change tasks, including initiation, engineering design, engineering approval and installation; and i. Minor projects in support of the Defence Program. <p>This also extends to other ports of operation in Australia, and internationally, as required by the Navy.</p>
L3 Oceania	<p>L3 Oceania, an Australian subsidiary of the New York-based company, supports Defence maritime ranges. It provides situational awareness and communications systems.</p>
Naval Ship Management (NSM)	<p>In WA, NSM employs 92 personnel and has developed an extensive local supply chain of SMEs and Original Equipment Manufacturers (OEMs). Approximately 80% of NSM's total supplier spend is with WA-based suppliers. Headquartered in the AMC, NSM is a long-term provider of complete sustainment services for the ANZAC Class Frigates, originally under the ANZAC Group Maintenance Contract and now as a member of the Warship Asset Management Agreement. Ship Refit, Repair and Refurbishment activities for the ANZAC Class Frigates occur at Fleet Base East (NSW), Fleet Base West and AMC.</p>
Raytheon Australia	<p>As the combat systems integrator for the Collins Class Submarines, Raytheon Australia is primarily located at the AMC and sustains a workforce of 80 employees working on the Collins combat system in-service support system. Raytheon also maintains a dedicated Collins workforce based at HMAS <i>Stirling</i>.</p>
Rolls-Royce	<p>Rolls Royce conducts maintenance of ANZAC Class propulsion systems, stabilisers and steering gear.</p>
Saab Australia	<p>Saab Australia Pty Ltd currently employs 55 personnel in WA who are primarily involved in supporting the ANZAC Class Frigates and various related capital projects. The services provided include:</p> <ul style="list-style-type: none"> • Provision of technical services in support of the Saab provided 9LV Mk3E Combat Management System and elements of the Gun and Missile Fire Control Systems; • Coordination of technical support services for other elements of the ANZAC Combat System • Provision of Combat System Engineering and Logistic Support services to the ANZAC SPO and ANZAC Class-related Shore Facilities; • Provision of Combat System Engineering services to various Capital projects involving the ANZAC (FFH) and Canberra (LHD) Class ships; and • Provision of Project Management services to the ANZAC SPO and other related Capital projects.

Serco (formerly DMS Marine)	Serco operates rescue vessels MV <i>Besant</i> and MV <i>Stoker</i> .
Thales Australia	In WA, Thales' activities comprise complex software and systems engineering for real-time combat and mission systems primarily within the maritime and secure communications domain. Thales also delivers in-service support to a number of naval platforms homeported in WA including the Scylla Sonar, the primary sonar system on the Collins Class Submarines, ANZAC frigate sonar equipment, Collins Class Submarine Platform Trainer and MU90 Light Weight Torpedos. Thales Australia employs a workforce of 150 staff in WA.
UGL Limited	UGL provides engineering support, manufacture, supply chain, maintenance and refurbishment. UGL also provides long-term maintenance support services for the ANZAC Class ships, also in Henderson, as part of a joint venture with Babcock called Naval Ship Management (Australia) Pty Ltd.

Table 9: Significant Suppliers and SMEs in the Western Australian Naval and Maritime Sector

1. All Go Engineering	All Go Engineering undertakes mechanical engineering - manufacturing and repair.
2. AMI Marine	AMI Marine is a distributor of maritime electronic, environmental and safety products.
3. APMS Engineering	APMS Engineering conducts pressure vessel fabrication - mild/stainless steel fabrication.
4. ASP Ship Management	Headquartered in Melbourne, ASP Ship Management 's Rockingham office is where it coordinates engineering and maintenance support and supply support services for HMAS <i>Sirius</i> .
5. Austindo	Austindo conducts the installation of electrical modules and cabling for weapons systems on all ship classes; through-life electrical planned maintenance of all RAN ships and submarines and submarine battery systems maintenance.
6. AVID Group	AVID Group does power generation upgrades and black-start generator controller works for RAAF Pearce; generator and AVR upgrades at Harold E. Holt communications facility, and standby generator upgrade works at Australian Defence Satellite Communications Station in Geraldton. It is a member of Royal Australian Navy ANZAC Fleet Technical Support Network.
7. Benalty Hovercrafts	Based at the AMC, Benalty Corp with its 123 years of combined shipbuilding experience specialise in the design, construction and delivery of commercial hovercrafts ranging from 10 to 40 metres to suit almost any operating environments in the world.
8. Cullys Marine Technology	Cullys Marine Technology provides electricians & electrical contractors.
9. Drivetrain Power and Propulsion	Drivetrain Power and Propulsion is the Collins Class diesel engine original manufacturer.
10. EJ Electrical	EJ Electrical provide electrical engineering contractors.

11. Forgacs Marine and Defence	<p>Forgacs Marine and Defence Pty Ltd (Forgacs) as a wholly owned subsidiary of Cimvec is an integrated, multi-disciplined construction and engineering services provider to the Maritime and Defence Infrastructure sectors. The engineering and vessel maintenance operations of Forgacs spans both sides of Australia with its facility at AMC comprising 200,000m² and its Newcastle facility spanning 227,000m². In early 2017, Forgacs partnered with ASC and was selected by two of the three shortlisted designers to deliver on the Australian Government's requirement for 12 new Offshore Patrol Vessels.</p>
12. Fremantle Foundry	<p>Fremantle Foundry conducts ship maintenance and repairs, and fabrication.</p>
13. Fremantle Hydraulics	<p>Fremantle Hydraulics conducts hydraulic manufacture, sales and service.</p>
14. HiFraser	<p>HiFraser specialises in niche hydraulic systems, pneumatic and vacuum system design, build, supply, maintenance and certification across the naval, offshore oil and gas, industrial gas, commercial marine, building, rail and aerospace sectors.</p>
15. Hoffman Engineering	<p>Hofmann Engineering is a international engineering provider to defence industry and supports the Defence maritime sector through a range of services from precision and heavy machining, onsite insitu machining, mechanical servicing, repair and maintenance and Defence projects to support the major primes in WA. Services supplied have consisted of onsite machining and gear manufacture for ASC; periscope work with BAE and repair and maintenance packages for NSM supported from its main workshop and head office in Perth. Hofmann Engineering also contributes to the ongoing sustainment of naval assets through the manufacture of spare parts, the overhaul of propellers, propeller shafts and onsite mechanical services in NSW and Victoria.</p>
16. IKAD Engineering	<p>Another WA based engineering firm, IKAD Engineering is a highly specialised mechanical and structural engineering company servicing a multi-faceted range of industries, including but not limited to Defence, marine, industrial, mining, oil and gas, and water technology sectors. Through IKAD's three WA based workshops, in addition to its premises in South Australia and New South Wales, it provides services in mechanical fitting, machining, dynamic balancing, fabrication and surface equipment among others.</p>
17. Jenkins Engineering Defence Systems (JEDS)	<p>Jenkins Engineering Defence Systems provide electronic engineering and antenna systems.</p>
18. JFD	<p>JFD provides submarine escape and rescue training and services, including an airlift-capable submarine rescue system.</p>
19. Kaefer Novacoat	<p>Kaefer Novacoat provides protective coatings and specialty linings.</p>
20. L2S Engineering	<p>L2S Engineering provides marine refits, upgrades, modernisations, Insulation and electrical services.</p>
21. Mackenzie Marine and Towage	<p>Mackenzie Marine and Towage provide harbour towage, pilot boats and boat lifting services.</p>
22. Marine and Construction Services (MCS)	<p>MCS conducts vessel and offshore maintenance and repair, and specialist personnel for naval defence systems.</p>

23. Marine Technicians Australia	Marine Technicians Australia conducts maritime electronic installations and maintenance.
24. Maritime Engineers	Maritime Engineers provide marine engineering consultancy, ship surveys, design services and marine advice.
25. Nova Systems	Nova Systems provides: maritime systems engineering, certification, systems safety, test and evaluation, specialty engineering and operational support; explosive ordnance management; and satellite communications and electronic warfare systems.
26. Orontide	Orontide provides maritime fabrication, fitting and engineering.
27. PCM Group	PMC Group provides protective coatings, abrasive blasting, water jetting, concrete remediation and fabrication.
28. Penske Power Systems (formerly MTU Detroit Diesel)	Penske Power Systems provide maintenance of ANZAC Class diesel engines.
29. Pozztech Engineering	Pozztech Engineering provides pressure vessel fabrication - mild/stainless steel fabrication.
30. PQR Quality Solutions	PQR Quality Solutions provides inspection and consulting services.
31. Royston Australia	Royston provides diesel power and generation.
32. Stace	Stace provides engineering and testing services.
33. UVS	USV provides and sustains Autonomous Surface Vehicles, Autonomous Underwater Vehicles and other Remotely Operated Vehicles.
34. VEEM	VEEM is the original equipment manufacturer of Worcester Valves for Collins Class submarines and provides specialised propellers, rudders and ship gyro-stabiliser equipment. VEEM has also provided fin stabiliser assemblies to Austal USA's Littoral Combat Ship and Joint High-Speed Vessel projects for the US Navy.
35. Watmarine Engineering Services	Watmarine conduct testing services (hydrostatic, ultrasonic, pressure, vibration) fabrication, pump repairs, blast and paint.
36. Weldtech Oilfield Services	Weldtech Oilfield Services provides marine vessel and platform mobilisations and installations, welding and steel fabrication.
37. Winchester Global	Winchester Global specialises in oil and fuel filtration products. The company manufactures its flagship and US patented Protxl by-pass oil and fuel filters that are designed to increase and optimize machine availability, performance and service life off all lubricated assets. Protxl products are used by a wide range of users including in the military, telecommunications, mining, power generation and marine sectors.

3.3 Defence Aviation and Sustainment

The defence of aviation sector in WA is estimated to be worth around \$200-250 million to the State annually, linked to multi-year contracts worth over \$2 billion, and directly employs around 300-400 people.¹⁰⁸ Due to the small air force profile in WA, most of the maintenance and sustainment activities conducted on aircraft based at RAAF Pearce, namely the PC9, Hawk 127 and PC21, is undertaken locally.

Table 10: Defence Aviation Contractors in Western Australia

<p>1. Aerospace NDI (ANDI)</p>	<p>ANDI provides non-destructive testing to civil and military clients and manufactures component works stands, transport and storage trolleys, hydraulic testing rigs, plus general and specialist tooling. The Company employs 17 staff and manufactures military components for Air Force’s PC-9 and the RSAF PC-21 fleet. Previous and current support includes PC-9 specialist maintenance non-destructive inspection, and for the PC-21 specialist maintenance, such as non-destructive testing, machining, electroplating and painting; and component maintenance emphasising wheels, brakes, hydraulics and flaps.</p>
<p>2. Air Affairs Australia</p>	<p>Based in NSW, Air Affairs Australia provides target towing services for the ADF, and conducts its WA operations out of RAAF Pearce.</p>
<p>3. Airflite</p>	<p>Airflite is a key local contractor to Defence providing comprehensive maintenance, repair and overhaul services. The company presently oversees maintenance for the 64 PC-9/A aircraft at RAAF Pearce and RAAF East Sale respectively, and has acquired a ‘life of type’ contract with Defence to provide sustainment support for the life of the fleet of PC-9/A aircraft. This includes extensive repairable item repair, overhaul and management responsibilities.</p> <p>Airflite also provides support for the CT4 aircraft fleet, based in the east, utilised for ab initio training, and also hold additional Defence contracts for the provision of life support services for the RAAF Air Sea Rescue Kits, manufacturing of hydraulic power carts for the Romeo Helicopters, and some sub-contracted component maintenance support to BAE Systems for the Hawk component maintenance.</p>
<p>4. Aquila Engineering</p>	<p>Aquila Engineering is headquartered in Sale, Victoria, and sustains an office in Bassendean, WA, where it provides engineering support services to Defence as sub-contractor to Pilatus for the PC-9/A fleet of trainer aircraft located at RAAF Pearce. Aquila Engineering is also contracted by Pilatus to provide support services to the PC-21 fleet.</p>
<p>5. BAE Systems Australia</p>	<p>Since the early 2000s, BAE Systems Australia has provided deep maintenance for the Air Force’s Hawk MK 127 Lead-in jet trainers. The fleet is made up of 33 aircraft, of which 14 are located at RAAF Pearce assigned to 79th Squadron. In July this year, BAE Systems’ Hawk fleet maintenance contract was expanded to include operational support and maintenance. This has relinquished the need for Air Force ground crew at RAAF Pearce, and has resulted in the growth of the BAE Systems’ workforce in a short period of time from 48 to 90 staff.</p>
<p>6. CHC Helicopter Services (CHC)</p>	<p>CHC is a key provider of helicopter search and rescue, and emergency medical services to the ADF across Australia. In WA, CHC provides rotary search and rescue coverage for training activities from RAAF Pearce to RAAF Learmonth, and to Albany in the South West. Similarly, when required CHC also provides ad hoc search and rescue services to Army in the North West of WA.</p>

108 Personal communication. Homer Constantinides, Managing Director, Airflite, 16 November 2015.

<p>7. Hawker Pacific</p>	<p>Since 2008, Hawker Pacific has worked in collaboration with Lockheed Martin and Pilatus in the delivery and sustainment of the 19 Pilatus PC-21 aircraft used for training by the Republic of Singapore Air Force at RAAF Pearce. The company also undertakes fixed base operations for Air Force VIP aircraft at Perth airport. In WA, Hawker Pacific employs 58 staff and has an annual turnover of \$48m in the State. Through Project AIR 5428, Hawker Pacific has secured a major contract with Pilatus to provide maintenance support to Air Force's 49 PC-21 training aircraft. This contract is a significant component of the 'Team 21' delivery of the new ADF Pilot Training System partnership between Lockheed Martin, Pilatus and Hawker Pacific, which provides Hawker Pacific further maintenance work at RAAF Pearce.</p>
<p>8. Hofmann Engineering</p>	<p>Hofmann Engineering offers a range of specialised tooling to support the manufacture of metallic and composite components and aero structures, together with the machining of composite and metallic components. The company provides solutions for major commercial and military aircraft programs, which include assembly jigs and fixtures, mould tools for composite manufacture, parts manufacture and assembly, machining of exotic materials including titanium, inconel, invar 36 and aluminium. Hofmann Engineering's customers include BAE Systems-Australia and the UK for the F-35 JSF Project, Boeing and GE with aerospace accreditation to AS9100 and ISO9001 quality standards.</p>
<p>9. Lockheed Martin Australia</p>	<p>Lockheed Martin Australia has remained the key contractor based in Perth responsible for training the Republic of Singapore Air Force 130 Squadron, equipped with PC-21 trainers, located at RAAF Pearce, where it employs 18 staff. The Lockheed Martin-led consortium 'Team 21', which partnered with Pilatus and Hawker Pacific, was recently awarded the AIR 5428 Pilot Training System contract by Defence valued at \$1.2 billion, to train the next generation of ADF pilots with the PC-21 trainer aircraft that will be operated from WA and Victoria. Performance-based options for up to 25 years will provide the opportunity to extend the length, and increase the value, of the total contract.</p>
<p>10. Orbital Engineering</p>	<p>Orbital Engineering is a Perth based firm that specialises in research, design, development and manufacturing, in addition to testing, validation and refurbishment services. At the heart of the company's innovative capability is UAVE which develops, produces and supplies engine and propulsion systems for unmanned aerial vehicles, while REMSAFE provides a fully patented remote electrical isolation system for global mining and industrial applications.</p> <p>UAVE harnesses 35 years of Orbital's innovation in engine development technology designing some of the world's leading engine and propulsion systems for Unmanned Aerial Vehicles. The company's UAVE division has enjoyed considerable export success in the United States with customers such as UAV manufacturers Insitu and Textron Systems, in addition to Boeing.</p>
<p>11. Pilatus</p>	<p>As a sub-contractor to Lockheed Martin for the Republic of Singapore Air Force for their Basic Wings Course, Pilatus also provides engineering and logistics support to Air Force's PC-9/A fleet at RAAF Pearce. Pilatus will also continue to support Air Force with its PC-21 replacement trainer aircraft, scheduled to be introduced before 2020. Under the contract, Pilatus shall continue to provide engineering, logistics and maintenance support, and has sub-contracted Hawker Pacific to provide aircraft maintenance on the PC-21 fleet.</p>
<p>12. Western Australia Specialty Alloys (WASA)</p>	<p>Western Australian Specialty Alloys (WASA) specialises in producing superalloy ingot, billet and bar for forging and ring rolling applications for a range of aerospace, power generation and oil & gas applications. WASA expertise in the defence aviation sector is reflected in the company's involvement with the F-35 JSF program and through its supply of master remelt alloy bar stock for PWA atomisation processes used to produce key components of the aircraft. WASA supplies nickel alloy to Pratt & Whitney for use in production of F-135 engine for the F35 Lightning II Joint Strike Fighter. The company employs 163 personnel and with an annual turnover of \$143 million.</p>

3.4 Army and Land

Although geographically isolated from the major Army formations and acquisitions infrastructure in the east, a small, yet diverse, land systems sector has developed in WA. Servicing the needs of the Army, both inside the State and beyond, local defence industry provides a range of services and products necessary to maintain a modern land force.

Table 11: Contractors to Army in Western Australia

<p>1. AVI</p>	<p>AVI is a designer, integrator and manufacturer of specialised communications systems and computers made to handle harsh conditions. The company has been successful domestically, with several major projects currently under way in the land-systems realm. AVI recently delivered a number of C2 and data processing systems as part of Defence’s Land Network development capability, and is currently building a fourth generation Image Capture and Transfer System for Defence. In April 2016, AVI delivered \$2.5m worth of C2 systems to the JP2097 Special Operations Vehicle.</p>
<p>2. Calytrix Technologies</p>	<p>As a WA-owned firm, Calytrix Technologies delivers complex training simulation to the Australian Defence Simulation and Training Centre, where the requirement for simulated training environments to prepare ADF personnel for combat has an integral role for Defence. Calytrix Technologies success has been noteworthy with Calytrix opening an office in Orlando, Florida, and has partnered with Bohemia Interactive Simulations as a service provider to the US Army’s ‘Games for Training’ simulator.</p>
<p>3. Geng</p>	<p>Geng specialises in product design and design for manufacture. It has provided engineering design for Defence Training Facilities around the country for 25 years, particularly in the live fire training area. Geng has exported targets overseas and is developing further targets in-house. A new non-lead, sub-sonic 5.56mm bullet has been developed and this has attracted interest both in Australia and the US.</p>
<p>4. Hofmann Engineering</p>	<p>Hofmann Engineering fabricates components for the M113 armoured personnel carrier, the Bushmaster and Hawkai Protected Mobility Vehicle and vehicle-mounted Command Ports from its facilities in Victoria. In this capacity, it acts as an approved supplier to both BAE Systems and Thales. In partnership with Calex Hofmann Engineering has provided engineering construction services to CASG on the Land 121 Phase 3A C4I and is currently manufacturing components for SupaCat. Although its Perth facilities handle minimal land systems work, it currently undertakes work on Army’s Unimog trucks as part of a sustainability package. Similarly, while its Perth facilities handle minimal land systems work, it has the ability to conduct 3MW gearbox and transmissions testing.</p>
<p>5. VEEM</p>	<p>VEEM has significant involvement in the production and maintenance of specialist vehicles for the Special Air Service Regiment. The company provides maintenance support and upgrades for the current fleet of 1A vehicles, and has been involved in the manufacture of the new generation 1B vehicles. This has included supplying assembled vehicles and fabricating chassis components for the prime contractor.</p>

“Servicing the needs of the Army, both inside the State and beyond, local defence industry provides a range of services and products necessary to maintain a modern land force.”



3.5 C4ISR

WA has a strong C4ISR (Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance) sector that supports strategic Defence communications facilities and ADF capabilities.

Table 12: C4ISR Contractors to Defence in Western Australia

<p>1. AVI</p>	<p>AVI has worked with Defence in the development of its command and control systems and its land network with Special Operations Command. Equipment for use on this network was fitted by AVI into Australian special operations vehicles, such as the Defence Land 2097 Project, where AVI supplied communications and command equipment.</p>
<p>2. BAE Systems</p>	<p>BAE Systems is the prime contractor for the development of the satellite ground station under JP 2008 Phase 3F.</p>
<p>3. Barrett Communications</p>	<p>Barrett Communications provides a range of communications for both Australian Defence and law enforcement agencies. It also exports this technology. In 2013, it sold High Frequency (HF) communications equipment to an East African Government, and a Central Asian Government; the latter for an order of over \$6 million. It has also sold comprehensive systems to the Nepalese and South African Armies. It is a company with a long track-record of export success.</p>
<p>4. Blacktree Technology</p>	<p>Blacktree is a WA-based company that is a current supplier to the ADF, with a reputation as a manufacturer of innovative components and systems that strengthen communication signals in the Narrowband UHF/SATCOM environment. Blacktree equipment is currently installed in Air Force, Navy and Special Air Services Regiment facilities across Australia. Blacktree has taken expertise developed in the Australian Defence environment to overseas markets. The company works with multinational prime contractors and Defence suppliers in Europe and the US and exports equipment for use in defence forces across the globe. At present, Blacktree equipment is installed in Germany, Italy, Japan, UK and the US.</p>
<p>5. Boeing Defence Australia</p>	<p>Boeing conducts ongoing maintenance for the Defence high frequency communications system located at Naval Communications Stations Harold E. Holt on the North West Cape.</p>
<p>6. Diamond Cyber Security</p>	<p>Diamond Cyber Security delivers intelligence led, threat centric, and targeted Information and cyber security services. Diamond Cyber provides a range of offensive and defensive cyber security consulting services including, but not limited to, penetration testing, Governance and Risk Compliance frameworks and policy development, incident response, Security and Risk Assessments, Managed Security Services. In addition to offering a range of catalogued services to the defence sector, Diamond Cyber also works with enterprises to assist in determining the commercial and operational feasibility of technologies and services for application within Defence.</p>
<p>7. Electro Optic Systems (EOS)</p>	<p>In 2014, Canberra-based defence technology company Electro Optic Systems (EOS) won a joint bid with Lockheed Martin to construct an entirely new space debris tracking centre located in Exmouth. The site will use a combination of lasers and sensitive optical systems – such as those found in telescopes – to detect, track and characterise human-made space debris objects.</p>

<p>8. Expert Knowledge Group (EKG).</p>	<p>EKG is a consultancy specialising in the provision of advice for the design, development, manufacture and commercialisation of high assurance security critical systems. In particular, EKG’s consultants specialise in assisting organisations build solutions that meet the criteria to be certified as high assurance and approved for processing highly classified data.</p> <p>EKG assists with the business and commercialisation of high assurance technology through advice on trusted manufacturing, trusted supply chain management, business management and funding. EKG has assisted a number of system integrators and product vendors in the design and development of cross domain solutions, secure communication systems and secure storage technology. These solutions/systems have been designed to process and protect highly classified data in Defence and across Government.</p>
<p>9. Fastwave Communications</p>	<p>Fastwave was established in 2001 as Australia’s first Iridium Satellite systems integrator. It specialises in developing integrated systems to provide real-time monitoring and data transfer from fixed and mobile assets on land, in the air and at sea. It has supplied specialised tracking systems to Australian Special Forces, portable aircraft tracking systems to US Government aviation contractors in Afghanistan and Iraq, and subsea sensor monitoring systems for maritime applications</p>
<p>10. L3 Oceania</p>	<p>L3 Oceania provides extensive support to Defence maritime ranges and is a provider of naval situational awareness, navigation and communications devices. The Company has supplied Wideband Terrestrial Satellite Terminals to the ADF and has a three-year support contract. Similarly, L3 Oceania has a three-year contract to sustain Navy’s navigation display systems.</p>
<p>11. Lockheed Martin Australia</p>	<p>Lockheed Martin has the contract to service the JORN facility at Laverton, WA, that employs 38 staff on a fly-in fly-out basis.</p>
<p>12. Raytheon Australia</p>	<p>Raytheon has a contract providing operations, maintenance and support services for Very Low Frequency communications at Naval Communications Station Harold E. Holt at Exmouth, where the company employs a workforce of 100 staff. This arrangement also includes support to the Space Situational Awareness Radar System, which is also located at Exmouth.</p>
<p>13. Secure Systems</p>	<p>In Australia, Secure Systems designs and manufactures high assurance portable data storage technology, branded as the Silicon Data Vault (SDV). The SDV High Assurance (SDV-HA) product is an Australian Signals Directorate (ASD) certified high assurance solution. The SDV-HA is approved to store Top Secret and Secret data yet allows the product to be handled as Unclassified when it is not powered. The SDV-HA incorporates tamper detection and response technology, strong Suite B encryption and many other security mechanisms to meet ASD requirements.</p> <p>Secure Systems products are used by numerous Defence and Government agencies that process, store and transport highly classified data. More recently the SDV-HA has achieved mutual recognition of its high assurance certification in the UK.</p>

<p>14. Takor Group</p>	<p>Based in Perth, the Takor Group, seeks to break the dominance of traditional geospatial companies by delivering new technology capable of democratising the industry. This objective was underpinned by the development of Takor’s own geospatial engine and platform called Koomba. Completely independent from other systems, Koomba represents a significant leap forward in the geospatial and mapping industry.</p> <p>From this innovation, Takor has created several products including Mappt, an Android-based mobile mapping solution. With more than 22,000 users in 80 countries, Mappt has gone on to become a leading mapping solution across several industries from agriculture to asset management. A key turning point for Takor was early 2017 when the US Department of Defense formally vetted and validated Mappt for military applications after 16 months of testing and security verification. Mappt Military allows soldiers to collect, process and share data in the field faster and more accurately, ensuring improved tactical decision-making.</p>
<p>15. Thales Australia</p>	<p>Thales Australia’s Systems/Software development covers many products and projects including the Ground Mission Management System (GMMS) for the ARH/MRH helicopters.</p> <p>Others include:</p> <ul style="list-style-type: none"> • Adelaide Class FFG Combat Management System Software Development & Support (ADACS is the name of the Combat Management System) • Orion IMARCS (a Patrol Boat C2 System currently deployed on the Cape Class Patrol Boats and many other Australian Border Force vessels). Continued product development + support + export opportunities • HAWKEI ICS -> The Integral Computing System being developed for the Hawkei Protected Vehicle R&D Activities • Wyvern -> Intelligence Gathering / Reporting tool/software delivered and supported under a large contract with CASG CISSO.



Photo courtesy of Department of Defence

“WA has a strong C4ISR (Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance) sector that supports strategic Defence communications facilities and ADF capabilities.”



3.6 Defence Logistics

The presence of JLU-West sustains a number of Defence logistics contractors that also work at equipment storage and distribution points at Defence facilities, such as Campbell Barracks, HMAS *Stirling*, Irwin Barracks, Leeuwin Barracks and RAAF *Pearce*.

Table 13: Logistics Contractors to Defence in Western Australia

1. Broadspectrum	Broadspectrum provides maintenance for materiel such as radios, vehicles and weaponry
2. Global Procurement Services	Global Procurement Services provide procurement and supply chain management
3. LINFOX	LINFOX provides distribution and warehousing services
4. Serco Sodexo Defence Services (SSDS)	SSDS provides clothing stores for the ADF

3.7 Defence Estate and Infrastructure

Defence base upgrades and sustainment is another area in which WA industry is heavily active. The WA defence sector is in the process of experiencing a major increase in work with the redevelopment of Campbell Barracks, HMAS *Stirling*, and the likely prospect of Irwin Barracks also undergoing a major redevelopment in the near future. Cumulatively, each of these projects are worth hundreds of millions of dollars to the State's economy.

In addition, there are many other national projects that have a component being built in WA, although it is difficult to determine what portion of the project costs relate to WA. According to Defence Estate and Infrastructure Group, these projects are Air7000-9000, LAND 121-17, Joint Health Services, Air Traffic Control, Airfield Pavements, LIFCAP in support of delivery of storage maintenance facilities at Campbell Barracks, REDFIN, and Pilot Train System - A54280.¹⁰⁹

Table 14: Defence Base Services Contractors in Western Australia

1. Augility	Augility conducts state works projects management
2. Aurecon	Aurecon provides state works project management
3. Broadspectrum	Broadspectrum has a significant proportion of Defence estate-related contracts in WA. They include construction, hospitality and catering, airfield fire-fighting and rescue, aircraft refuelling and facilities management. Broadspectrum supports Defence's logistical and management requirements of land material, equipment and systems services, as well as maintaining land-based equipment and refurbishment.
4. Cushman and Wakefield	Cushman and Wakefield provides property lease and license management, and estate works program management

¹⁰⁹ Personal communication. Gavin Nicholls, Director Estate and Facilities Services, Central and West, Defence Estate and Infrastructure Group. September 14, 2017.

5. Veolla	Veolia provides waste management services
6. Wilson Security	Wilson Security provides access control and security guard services

Table 15: Defence Estate Capital and Maintenance Contractors in Western Australia

1. AECOM	AECOM is a Design Contractor for the Campbell Barracks redevelopment, and for the Joint Health Facility Campbell Barracks
2. Clayton UTZ	Clayton UTZ provides legal services
3. Coffey	Coffey provides design for the Space Surveillance Telescope – Exmouth
4. Decmil	Decmil is conducting RAAF Learmonth and HMAS Stirling Defence Fuel Installation (DFI) refurbishment
5. Doric	Doric is the Managing Contractor (MC) HMAS Stirling Redevelopment 3A (\$367M)
6. Duratech	Duratech has a contract for the HMAS Stirling Low Level Bridge refurbishment (\$13M)
7. GHD	GHD is the Project Management / Contract Authority (PM/CA) fir Campbell Barracks redevelopment, and design for HMAS Stirling Redevelopment 3A
8. Jacobs	Jacobs is the PM/CA for RAAF Learmonth and HMAS Stirling Defence Fuel Installation (DFI) refurbishment, and for the design for RAAF Pearce Potable Water upgrade
9. LendLease	LendLease is the Head Contractor (HC) Campbell Barracks redevelopment, LAND 17 Phase1B/C and JP 2097 Phase 1B REDFIN Infrastructure projects (\$330M combined total), Managing Contractor (MC) Air Traffic Control Complex Infrastructure and Fixed Base Defence Air Traffic Management & Control System (AIR 5431 Phases 2 & 3) RAAF Base Pearce and RAAF Gingin. Lendlease has tendered and engaged 98% of the project trade packages. 87% of these have gone to WA sub-contractors primarily located within a 50km radius. The value of these packages represent 89% of the tendered trade packages.
10. RPS – Project Management	RPS has a contract for PM/CA HMAS Stirling Redevelopment 3A, PM/CA JP 2047 Phase 3 Defence Terrestrial Communications Network Facilities Upgrade and PM/CA RAAF Pearce Potable Water upgrade
11. St Hilliers	St Hilliers provides Pilot Training System Facilities – RAAF Pearce (AIR 5428 Phase 1), and Corrosion Control Facility refurbishment – RAAF Pearce
12. Telstra	Telstra is providing the Defence Terrestrial Communications Network Facilities Upgrade

3.8 University and Tertiary Institutions

The university and tertiary education sector in WA plays a key role for the local defence sector in providing both specialised training, and fostering innovation through research and development.

Table 16: Defence-Related University and Tertiary Institutions in Western Australia

<p>1. CCI Industrial Training Institute</p>	<p>Scientific Management Associates (SMA) (Operations) Pty Ltd is the primary contract holder in respect to providing Technical Training Support Services for Navy Australia wide. SMA is a Registered Training Organisation (RTO) which conducts Vocational Initial and Advanced Technical Training to Defence. This training for the Navy has been managed by SMA since July 1998, contracting ITI from that time and contracting the WA TAFE institutions, such as South Metro TAFE, from 2004. The courses contracted continue to adapt to the modern-day capability and requirements of Navy.</p> <p>The CCI Industrial Training Institute (ITI) has been training the next generation of West Australian defence tradespeople since 1998. As an initiative of the Chamber of Commerce and Industry of Western Australia (CCI), ITI has a purpose-built facility at WA’s Naval Base located close to Henderson’s renowned Marine Complex, where it places emphasis on safety and risk management.</p> <p>ITI is one of the largest private RTOs for WA’s defence sector. ITI deliver specialist accredited courses for Navy for UEE and MEM training packages (Electrical, Instrumentation, Fluid Power and Fabrication). Over 400 Navy students have completed the course at ITI. ITI currently delivers training to Defence contractors in respect to the shipbuilding industry; the qualifications are in the following streams Marine Fitting, Fabrication (Marine) and Electrotechnology (Electrician).</p>
<p>2. Curtin University</p>	<p>In 2017, the Academic Ranking of World Universities rated Curtin University in the top one percent of universities worldwide. Curtin University strives to connect research expertise with industry, government and the community. In its fiftieth year of existence, Curtin is positioning itself for WA’s next wave of industry, bolstered by the Commonwealth Government’s ambition to foster an enduring national shipbuilding industry.</p> <p>Curtin has collaborative agreements with several defence-focussed organisations and has completed numerous defence-related research projects. This includes the Centre for Marine Science Technology (CMST) which was established in 1985, which conducts research on the hydrodynamics and acoustic performance of ships and submarines operating in shallow waters. Similarly, Curtin’s Advanced Signal Processing Group is a world-leader in target tracking and decision support. It was awarded the Eureka Prize in 2010, and has since been deployed internationally to Defence forces, as well as commercially. Curtin maintains ongoing working relationships with DST Group on a range of initiatives from space situational awareness, structural dynamics and condition monitoring, through to optimisation/industrial modelling, and human operational performance.</p>
<p>3. Edith Cowan University (ECU)</p>	<p>ECU is recognised as one of the top 10 universities in the world and Australia’s leading university in cyber security research and education through the combined expertise of ECU’s Security Research Institute (ECUSRI) and Computer and Security Science Group. ECUSRI combines computer science, information technology, law and cognitive psychology to conduct multi-disciplinary research across four themes: digital forensics, cyber security, critical infrastructure security and human security. Building upon ECU’s national reputation, ECU was recently recognised by the Commonwealth Government as one of only two Academic Centres of Cyber Security Excellence in Australia.</p> <p>As part of the DST Group Academic Partnerships Program and Defence Industrial Security Program, ECU is engaged by Defence to deliver in-time cyber security research and specialised professional training. Similarly, ECU’s growing profile with the defence industry has led it to enter into a strategic partnership with Austal to develop the Maritime Research and Innovation Institute focusing on Smart Ships and near generation solutions.</p>

<p>4. ERGT Australia</p>	<p>ERGT Australia (ERGT) is a Registered Training Organization (RTO) and Delegated Authority by the Australian Skills Quality Authority (ASQA). Incorporated in 1994, ERGT has been delivering safety skills and emergency response training, including Helicopter Underwater Escape Training. Since inception, ERGT has trained in excess of 100,000 trainees. ERGT was awarded an Australian Defence Force (ADF) contract in 2015 for the delivery of ADF HUET courses at military training centres including HMAS Albatross, Nowra NSW and Lavarack Barracks, Townsville QLD. ERGT also delivers HUET for ADF personnel in Darwin, Brisbane and Adelaide. This safety critical training is delivered to military aircrew and Australian Defence personnel who are exposed to overwater flight by helicopter.</p> <p>In addition, ERGT is registered on the ADF Work Health and Safety (WHS) Education and Training Panel for the delivery of WHS courses at Certificate IV, Diploma and Advanced Diploma levels. ERGT employs a number of ex-military trainers because of their ability to understand and manage risk in stressful environments and their experience in the application of aligned skills. ERGT supports the ADF community primarily from its three specialist training centres in Perth, Melbourne and Darwin. ERGT is also an approved provider by the international Offshore Petroleum Industry Training Organization (OPITO) and is also accredited by the Australian Maritime Safety Authority (AMSA), the Australia Petroleum and Production Exploration Association (APPEA) and the Texas A&M University (TEEX) to deliver a range of safety skills and emergency response courses into various industry sectors including Defence.</p>
<p>5. Industrial Foundation For Accident Prevention (IFAP)</p>	<p>IFAP's Offshore & Maritime Training Centre has been providing training for the ADF since 1994. Over the years IFAP has provided off the shelf and customised training courses in many forms to assist the defence force in producing high quality training for its existing and new personnel. The use of a high fidelity Canadian manufactured Modular Egress Training Simulator (METS) for Helicopter Underwater Escape Training (HUET) allows for HUET training to be delivered utilising a setup similar to that of the helicopters being used in service.</p> <p>The IFAP Fremantle training facility is also used for Air Force new recruits completing their Pilot Training. These recruits complete a series of in-water Sea Survival training exercises completing such tasks as life jacket use, treading water for a pre-determined period, escaping from underneath a parachute canopy etc. The Fremantle training facility is located in the protected waters of Rous Head harbour with access to the sheltered harbour ideally suited for their range of life boats and rescue boats. The facility has proved ideal for providing demonstrations for military helicopter winching exercises performing casualty extraction from in water, from a rescue boat or from a life boat.</p>
<p>6. Murdoch University</p>	<p>Murdoch University will host a defence innovation hub at its Rockingham campus after the City of Rockingham signed an MoU with France. Dubbed 'Rockingham Renaissance' the initiative seeks to capitalise on the close proximity of HMAS Stirling to Rockingham, and the fact that French-shipbuilder DCNS (now Naval Group) was awarded the contract to build 12 new Barracuda Class submarines as part of the Future Submarine Program. As part of this initiative, the City of Rockingham is formalising a sister-city relationship with the City of Cherbourg, a major centre for submarine and shipbuilding activity in France.</p>
<p>7. South Metropolitan TAFE</p>	<p>South Metropolitan TAFE is one of Western Australia's most diverse registered vocational education and training (VET) providers. It is the biggest trade college in WA covering a range of defence and shipbuilding related skills in engineering, logistics, ship building, submarine maintenance, maritime and defence trades. South Metropolitan TAFE is a major provider of defence and shipbuilding training to defence primes and supply chain industry partners, including the provision of technical training services for the Navy and the Collins Class Submarine Training Services through subcontracting arrangements. The TAFE provides customised and off-the-shelf training in a wide range of industry areas, many of which have shipbuilding and defence applications</p> <p>South Metropolitan TAFE offers numerous dedicated defence programs that create a pathway between schools, TAFE, higher education and the defence sector. High school students in years 11 and 12 can begin their defence career journey via range of study areas through South Metro TAFE's VET in Schools programs. South Metropolitan TAFE has a long-standing relationship with Scientific Management Associates (SMA) Pty Ltd (via a sub contract agreement) to deliver a wide range of trade and post-trade training programs for Navy. These include specialist courses to Navy for electrical systems, hull, propulsion and diesel maintenance, maritime operations and control systems.</p>

8. University of Western Australia (UWA)

As among the world's top 100 universities UWA supports the naval shipbuilding industry with leading strengths in marine engineering, automation and sensing. UWA has a track record of undertaking defence-related research and development projects. Since 2008, UWA has twice been the recipient of the DST Group sponsored Eureka Prize for Outstanding Science in Safeguarding Australia.

In 2015, the internationally renowned UWA Indian Ocean Marine Research Centre, which collaborates in partnership with the CSIRO and three other research institutions, including the UWA Oceans Institute, used advanced computer modelling to predict the location of fallen aircraft debris from the missing Malaysian Airlines flight MH370. In 2016, UWA was awarded two DST Group grants to investigate the impact of submarine operations on the psychological wellbeing of sailors. UWA is also involved in the planning stages in two of five planned mid-scale collaborative research projects, worth a combined \$9 million in funding.



University of Western Australia (UWA)

3.9 Miscellaneous Technologies

The diversity of capabilities within WA's defence industry is demonstrated by the wide array of companies that have succeeded in providing niche capabilities to Defence in Australia, and to overseas markets.

Table 17: Miscellaneous Defence-Related Technology Companies in Western Australia

<p>1. Armour Technology Australia</p>	<p>Armour Technology Australia (ATA) specialises in designing, manufacturing, supplying, installing and delivering retrofit ballistic and blast composite armour wailing and armour glass protection technology for a wide range of clients particularly for governments, military law enforcement sectors, in addition to the commercial security market.</p>
<p>2. Agent Oriented Software (AOS)</p>	<p>AOS a world leading company in the field of autonomous decision-making software. The company offers two main capability streams through its autonomous decision-making software applications as demonstrated through both its Intelligent OPFOR System (IOP) and Intelligent Watchdog System (IWD). Pioneered by CoJACK, AOS's multi-agent reasoning software, the IOP system is the next generation of technology that is used to transform targets into an OPFOR. The system is capable of detecting trainee positions and enabling moving and static targets to act as reactive OPFOTR capable of attacking and counterattacking as well as triggering environmental effects.</p> <p>A recently developed IOP Interface Box provides the means to transform a wide range of commonly available targets from 'pop ups' through to autonomous mobile targets, into cohesive OPFOR. AOS also offers its Intelligent Watch Dog system which is powered by C-BDI. It is AOS's latest and most advanced multi-agent reasoning software and is capable of autonomously monitoring tripwire and radar sensors for intrusion detection. Likewise, the system can select appropriate response vehicles to investigate and relay real time video footage back to human supervisors at the command post.</p>
<p>3. Carnegie Clean Energy</p>	<p>Carnegie Clean Energy is an innovative developer of a wide range of utility scale solar, battery, wave and hybrid energy projects giving the company the distinction of been the only one of its kind in the world offering a combination of wave, solar, wind, battery storage and desalination via microgrids. A key project currently being undertaken by the firm with synergistic potential with the defence sector is the development of its CETO wave energy process that seeks to harness renewable energy sources in the ocean and convert it into both zero emissions electricity and desalinated water. The firm's CETO 6 Project at Garden Island in collaboration with the Department of Defence will also provide the island with the world's first wave integrated renewable microgrid project, in addition to the CETO wave-energy system.</p>
<p>4. Composite Components</p>	<p>Perth-based Composite Components is an award-winning designer and manufacturer of composite parts and assemblies. The company produces components and assemblies for aerospace, Army, naval, sub-sea and medical applications, nationally and internationally. The company has over 15 years of experience in UAV design, prototype and production. Composite Components is well regarded as one of WA's leading advanced composite manufacturer with CAD/CAM/FEA/CFD & production facilities.</p>
<p>5. Dialog Information Technology</p>	<p>Dialog Information Technology's Google solutions practice develops and deploys Glass for Enterprise wearable technology. Dialog also build custom applications for the medical, utilities, logistics, aerospace and Defence sectors. Dialog has a long history of working with Defence in the use of Google Cloud Platform, including with machine learning, collaboration, storage, teaming and data, and has an established reputation for the implementation of mapping technology in the national security sector.</p>
<p>6. Marathon Targets</p>	<p>Marathon Targets is a Sydney-based company that specialises in providing realistic robotic targets that help the ADF improve combat training outcomes including precision combat marksmanship and enhanced combat skills. Marathon provides targets that simulate realistic adversary combatant targets and are used in urban, field training and shooting range environments. Marathon is moving to supply other Army units of the ADF, having been engaged by the SASR in WA for many years. The product is also being exported other armed forces around the world.</p>

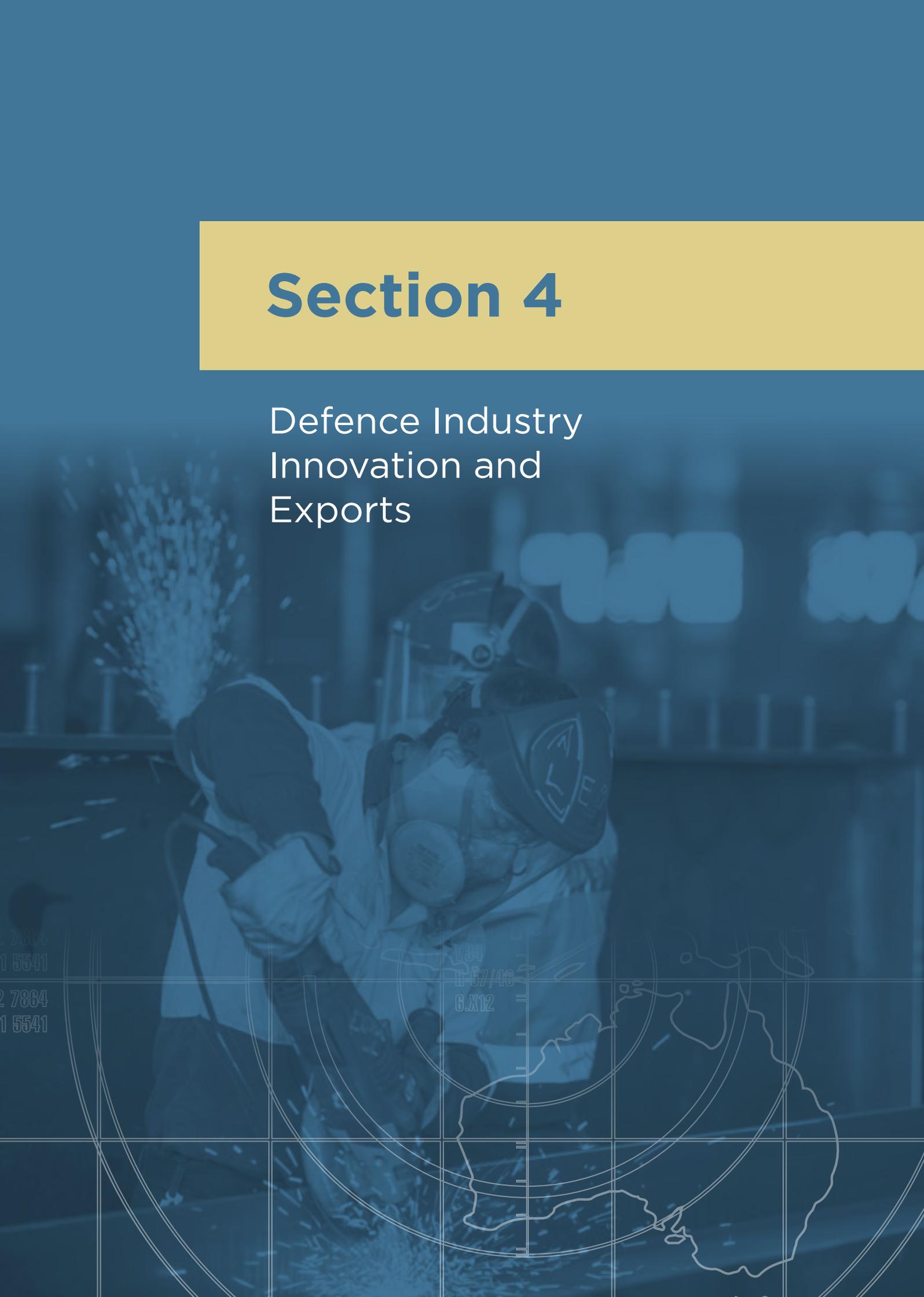
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Section 4

Defence Industry
Innovation and
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Section 4:

Defence Industry Innovation and Exports

Australia has entered an era of significantly increased Defence spending, with the Commonwealth Government aiming for a Defence budget of 2% of GDP by FY2020-21.¹¹⁰ The *2016 Integrated Investment Program* has pledged around \$195 billion in investment until FY2015-26, to develop Australia's Sovereign Industrial Defence capability.¹¹¹ The opportunities arising out of these recently-created Commonwealth funding programs and initiatives create excellent opportunities for the expansion of WA's defence industry, particularly in relation to Defence and industry innovation and collaboration, and defence exports.

4.1 Synergistic Innovation

Defence and defence industry have already entered into a new era of collaboration and investment, and these new arrangements provide WA industry with access to funding and support from the Commonwealth. The provision of new and expanded Commonwealth defence industry innovation and grant schemes are characterised by the launch of the Centre for Defence Industry Capability (CDIC), the Defence Innovation Hub, and the Next Generation Technologies Fund (NGTF), which form the new integrated Defence innovation system. This also creates excellent potential for cross-disciplinary synergies across a range of industries, but particularly in those that possess dual-use technologies – ie. technologies that have both civilian and Defence applications.

The CDIC, delivered through AusIndustry, and funded by Defence, will help to transform the Defence and industry relationship, and will fund new industry development, critical skilling and export programs, and facilitate access to

Defence's new innovation programs for SMEs. It is the key Commonwealth interface with Australian industry, providing advice that supports industry growth and facilitates innovation. The CDIC has received a funding allocation of around \$230 million until FY2025-26.¹¹²

The NGTF is a forward-looking program focussing on research and development in emerging and future technologies for the next generation of the ADF. Managed by the DST Group, the NGTF has been allocated \$730 million in Commonwealth funding until FY2025-26, and will take the lead in identifying, conducting and integrating research in next generation technologies.¹¹³ The DST Group will work collaboratively with academia, publicly-funded research agencies, Australian industry, other areas of Defence and Government, and alliance partners to create a collaborative innovation capability.

110 Department of Defence. *2016 Defence Industry Policy Statement*. 2016. Accessed October 14, 2017: <http://bit.ly/2zRRn0Y>. p. 15.

111 Department of Defence. *2016 Defence Industry Policy Statement*. 2016. Accessed October 14, 2017: <http://bit.ly/2zRRn0Y> pp. 23, 25.

112 Australian Government. "About the CDIC". December 5, 2016. Accessed October 14, 2017: <http://bit.ly/2A1SKLj>

113 Defence Science and Technology Group. "Next Generation Technologies Fund". 2017. Accessed October 9, 2017: <http://bit.ly/2ihdE0Z>

The priority areas of the NGTF emphasise:

- integrated intelligence;
- surveillance and reconnaissance;
- space capabilities;
- enhanced human performance;
- medical countermeasure products;
- multidisciplinary material sciences;
- quantum technologies;
- trusted autonomous systems;
- cyber; and
- advanced sensors, hypersonics, and directed energy capabilities.¹¹⁴

The Defence Innovation Hub has received a funding allocation of up to \$640 million until FY2025-26 to enable Defence and industry to undertake collaborative innovation ventures throughout the Defence capability life-cycle from initial concept, through prototyping and testing, to introduction into service.¹¹⁵

Attracting greater research and development to WA's universities is central to developing synergies with defence industry. The increased availability of Commonwealth funding has already provided opportunities for WA-based companies and institutions to access funding programs. According to the CDIC, between December 2016 and August 2017, 25 WA businesses applied for a CDIC Advisory and Facilitation Service. Based on this 13 companies are currently receiving CDIC services, with a further 12 applications currently being processed, and one company having received a Capability Improvement Grant for \$42,000.¹¹⁶

As at May this year, universities in WA had received slightly over \$280,000 NGTF funding out of the \$5.5m awarded by Defence university partnership projects.¹¹⁷ At Edith Cowan University, two projects were selected. These were Advanced Biometric Template Protection: Design of a Cancellable Biometric Framework at \$97,729; and Cyber Electronic Warfare – The Effects of Team, Cognitive Load and Team Mental Models at \$99,369. At Curtin University, the project selected was Towards Integrated (Wide Field Space Event Detection and Precision Tracking) SSA from Distributed Optical Sensors at \$86,206.¹¹⁸

To ensure the needs and sustainment activities for the future ADF are met, the *2016 Integrated Investment Program* makes clear the six priority capability streams, which emphasise:

- key enablers and maritime and anti-submarine warfare each with 25% of the Defence budget;
- land combat and amphibious warfare with 18% of the Defence budget,
- strike and air combat with 17% of the Defence budget;
- intelligence, surveillance, reconnaissance, electronic warfare, space and cyber with 9% of the Defence budget; and
- air and sea lift which is receiving 6% of the Defence budget.¹¹⁹

As indicated in Section 3, WA industry has a much greater capacity and untapped potential to value-add in the sphere of defence industry innovation. There are numerous commercial enterprises with transferable capabilities and/or dual-use technologies that would be

114 Department of Defence. *2016 Defence Industry Policy Statement*. 2016. Accessed October 9, 2017: <http://bit.ly/2zRRn0Y>. p. 32.

115 Department of Defence. *2016 Defence Industry Policy Statement*. 2016. Accessed October 9, 2017: <http://bit.ly/2zRRn0Y>. p. 30.

116 Email correspondence. Lois Wake, Strategic Engagements and Communications Manager, CDIC, August 3, 2017.

117 Department of Industry, Innovation and Science. "Next Generation Technologies Fund – University Partnerships". May 26, 2017. Accessed October 9, 2017: <http://bit.ly/2zRRv00>

118 Australian Government. "Next Generation Technologies Fund - University Partnerships". 2017.

119 Department of Defence. *2016 Integrated Investment Program*. 2016. Accessed October 9, 2017: <http://bit.ly/2iheoDj> p. 24.

applicable to Defence, but have yet to secure Defence contracts in Australia. Selected examples include:

- Armour Technology Australia's unique ballistic and armour technology;¹²⁰
- Benalty Corporation's hovercraft designs;¹²¹
- Evolution Defence, a subsidiary of Evolution Commercial, which undertakes production of vessels and other large, custom structures manufactured from either aluminium, steel or fibreglass (FRP)/composites;¹²²
- GRD Franmarine's Envirocart water capture and containment hull cleaning technology;¹²³
- Nauti-Craft's passive-reactive interlinked hydraulic marine suspension system;¹²⁴ and
- Sci-Aero's domestically developed and produced drone and aerial mapping technology.¹²⁵

The winding down of the resources boom has spurred the recently-elected WA Government to pursue a diversified economic strategy, which has given defence industry greater prominence in the State's future calculus. WA Premier, Mark McGowan, in April 2016, stated: "WA has a golden opportunity to play a big role in building the future generations of Australia's Defence infrastructure. As our economy transitions away from mining, Defence will be a key part of diversifying the economy and creating jobs for the future."¹²⁶

Moreover, as emphasised by the newly formed Office of Defence West, there are numerous potential collaborative and spin-off opportunities from the resources sector that have Defence applications. A recent statement made by the Office, consolidated this further:

Defence is a key pillar of Western Australia's economy. Western Australian industries have the capacity and expertise to deliver across all capability streams such as maritime and anti-submarine warfare; land, air, space and amphibious combat; intelligence, special operations, and surveillance and cyber warfare. Our universities and industry players have accrued experience in the demanding offshore oil and gas and mining sectors - much of this knowledge and capability has dual application to the defence sector.¹²⁷

120 Armour Technology Australia. "Welcome to Armour Technology Australia". 2015. Accessed October 14, 2017: <http://bit.ly/2iheMSh>

121 Benalty Hovercrafts. "Commercial Hovercrafts". 2017. Accessed October 9, 2017: <http://bit.ly/2zTHwrd>

122 Evolution Commercial. "Company overview". 2016. Accessed October 9, 2017: <http://evolutioncommercial.com.au/about/>

123 GRD Franmarine Holdings. "Award-Winning, Enviro Friendly Solutions". August 21, 2015. Accessed October 9, 2017: <http://bit.ly/2z6TRvd>

124 Nauti Craft. "Nauti- Craft shortlisted for the prestigious 2017 Maritime Australia Industry Innovation Awards". September 14, 2017. Accessed October 9, 2017: <http://www.nauti-craft.com/news.html>

125 Scientific Aerospace. "Remote Asset Inspection". 2016. Accessed October 9, 2017: <http://sci.aero/4scight-3/>

126 McGowan, Mark. "A McGowan Labor Government will create Defence West to create more jobs in WA. WA Labor Party. April 27, 2016. Accessed October 14, 2017: <http://bit.ly/2zRS8qQ>

127 Western Australia: Our Defence Capabilities (Office of Defence West Brochure, publication date unknown).

An outstanding example of existing industry collaboration between Defence, defence industry and the resources sector in WA is located at the AMC at Henderson. Within this precinct there are numerous defence sector companies that also service the resources sector. According to the defence industry advocacy group, Henderson Alliance, around 75% of local Defence SMEs are, to varying capacities, already engaged in work within the resources sector.¹²⁸ Conversely, however, there appear to be comparatively fewer resources sector companies that are involved in the defence sector.

For many years the resources sector in WA has been at the helm of global innovation of cutting edge technologies. WA is the location of the first two mines in the world using automated and remotely-operated trucks. Rio Tinto uses dozens of driverless trucks called autonomous haulage vehicles, across three separate mine sites that are remotely operated from its Perth operations centre located 1,200km away. The trucks have the ability to operate 24 hours a day, 365 days a year, and save an estimated 500 annual work hours, which would normally be undertaken by staff. These driverless trucks are produced by Japanese company Komatsu, supported by precision GPS and radar and laser sensors to prevent collisions.¹²⁹

The technological advancements have reduced staff numbers and made personnel available for more specialist tasks. Rio Tinto has also commenced trialling driverless trains and remotely-operated drills, developments that share critical technology with emerging and future developments in network-centric warfare.¹³⁰ BHP and Fortescue Metals

Group have followed suit, launching similar technology at their Pilbara mines.¹³¹ BHP is exploring additional fourth industrial revolution technologies such as robot-controlled crewless 'ghost ships', which could lead to annual potential savings of at least \$86 billion.¹³²

There is the potential for technology of this nature to be utilised in a variety of Defence roles such as driverless patrol vehicles, reconnaissance, improvised explosive device detection and clearance, unarmed armoured heavy vehicles, and for the safe transportation of chemical, biological and radiological materials. Yet in order to operate in unstable environments, the armoured heavy vehicles would require significant upgrade and modifications in order to meet Defence requirements and applications, as already seen with several US Army Autonomous Military Vehicles. However, while heavy vehicles in the mining sector operate on an automated haulage system, travel a pre-determined route along known topography, which contrasts with the driverless vehicle technology requirements in the defence domain necessary to navigate unknown or complex terrain, all weather conditions, and able to respond or mitigate hostile attempts to disable or interrupt the vehicle.¹³³

Defence could also take initiative from other technologies in the mining sector, including tele-remote ship loaders, automated rock breakers and semi-autonomous crushers. The Defence applications of these technologies have yet to be fully explored, but demonstrate the potential synergies of mining technologies both in the land and maritime domains. As stated by Minister for Defence Industries,

128 Personal communication. Henderson Alliance, October 10, 2017.

129 Simonite, Tom. "Mining 24 Hours a Day with Robots". *Technology Review*. December 28, 2016. Accessed September 4, 2017: <https://www.technologyreview.com/s/603170/mining-24-hours-a-day-with-robots/>.

130 Crozier, Ry. "Rio Tinto advances autonomous drill project". *IT News*. August 16, 2012. Accessed October 14, 2017: <https://www.itnews.com.au/news/rio-tinto-advances-autonomous-drill-project-312004>

131 Vanzyl, Gareth. "Mining giants BHP Billiton, Rio Tinto eye 'ghost' controlled ships, trains". *Biz News*. June 7, 2017. Accessed September 4, 2017: <http://www.biznews.com/tech/2017/06/07/bhp-billiton-rio-tinto-ghost-ships-trains/>.

132 Vanzyl, Gareth. "Mining giants BHP Billiton, Rio Tinto eye 'ghost' controlled ships, trains". 2017.

133 Turnbull, Grant. "Off the shelf – re-thinking innovation in the military". *Army Technology*. March 3, 2014. Accessed September 4, 2017: <http://bit.ly/2lvqIVh>.

Christopher Pyne:

Existing autonomous and robotic systems that operate in the manufacturing and mining sector are effective in controlled environments but not suitable for the uncertain situations in which Defence operates. To be effective, Defence needs autonomous systems to be highly trusted, robust, and resilient and this initiative will bring together the best researchers from industry and universities to develop the intelligent military platforms of the future.¹³⁴

Automated mining technology has direct application for the Trusted Autonomous Systems Cooperation Research Centre (CRC), launched by Defence in July 2017.¹³⁵ The NGTF awarded \$50m in funding over a seven-year period to establish the CRC based in Adelaide, and chaired by University of South Australia. The new CRC will provide opportunities for collaboration between universities, research institutions and industry to develop new Defence capabilities.¹³⁶ The centre will investigate new technologies including long range drones (more commonly known in Defence as Unmanned Aerial Vehicles, or UAVs) for ocean surveillance and driverless vehicles for the purposes of evacuating casualties and delivering supplies more safely during battlefield environments. Indeed, this warrants the WA Government in cooperation with the Commonwealth, to look at establishing a hub in WA, of the recently announced Defence CRC for autonomous systems proving ground in collaboration with the tertiary sector.

In light of this, it is evident that WA's advanced capabilities in the resources sector, which is already heavily utilising automation and robotics, has a strong future to harness synergies with Defence. This is substantiated by Winthrop Professor Mohammed Bennamoun, Head of the Robotics and Automation Group, University of Western Australia, who stated:

Mobile robotics is becoming increasingly central to Defence, as not only can it reduce costs, but more importantly protect people. The range of research expertise from sensors to communication equipment that is applicable, and the rapid rate of technology development to perform activities from patrols to security, means that robotics can help to respond more effectively to the challenges of today and in the future. The functionality and requirements between the Defence and Resources sectors are very similar, and the level of autonomy that is being developed for the Resources sector will only naturally evolve into defence industry capability.¹³⁷

Unmanned aerial vehicles have been used prolifically by militaries for over decade and are increasingly finding utility in the mining sector,¹³⁸ signalling clear opportunities for future synergies in research and development and application. The resources sector is increasingly utilising drone technology to enhance mine site efficiency and safety. Again, a good example is provided by Rio Tinto, which is trialling drones, rather than personnel, to inspect its equipment and mining pits in WA.¹³⁹

134 Pyne, Christopher. "\$50 million for Industry and Defence to work together on Trusted Autonomous Systems." *Department of Defence*. July 6, 2017. Accessed October 14, 2017: <http://bit.ly/2zUDizK>

135 Pyne, Christopher. "\$50 million for Industry and Defence to work together on Trusted Autonomous Systems." 2017.

136 Pyne, Christopher. "\$50 million for Industry and Defence to work together on Trusted Autonomous Systems." 2017.

137 Personal communication. Mohammed Bennamoun. Head of Robotics and Automation Group. University of Western Australia, October 3, 2017.

138 Crozier, Ry. "Australian miners send drones to work". *IT News*. May 28, 2012. Accessed September 4, 2017: <http://bit.ly/2z6eesh>

139 Crozier, Ry. "Australian miners send drones to work". 2012.

UAV technology in the resources sector is pushing into territory such as environmental scanning, subsidence monitoring, pit wall mapping, infrastructure assessments, and even spare parts transportation to offshore LNG platforms.¹⁴⁰ Given the major advances in Defence UAV technology it is evident that there is significant potential for UAV technology transfer from the Defence domain across to the resource sector.

In the undersea domain, there are considerable synergies between the offshore oil and gas industry and Defence. Undersea technology, specifically for deep water and ultra-deep water, is evolving at a considerable pace to meet increasing global demand in new conventional and non-conventional fossil fuels and mineral reserves.¹⁴¹ Undersea robotic technology has specific utility across the Defence and resources sector, including tele-operation of drilling and production platforms, remote operated vehicles (ROVs), autonomous underwater vehicles (AUVs), under-water welding, and welding robots for double-hulled ships.¹⁴² This commercial technology has the advantage of having been developed for remote, extreme, hostile or difficult environments, thereby lending itself well to military application.

WA is already an internationally recognised innovation hub in the mining and offshore petroleum/natural gas sectors.¹⁴³ Research and development in the resource sector drives technological development in the Australian economy and reflects the strong public-private partnerships between both industry and the tertiary sector.¹⁴⁴ There are a number of natural linkages between the resources and tertiary sectors and Defence.

In particular, and working to WA's strengths, there is significant crossover between offshore gas and the naval and maritime sector. The transferable skillsets that would allow people involved in the engineering and technical areas of the offshore sector to easily make the transition to defence work. Given the increase in demand for defence materiel, labour currently engaged in the Liquefied Natural Gas (LNG) sector could well be used in naval engineering, which has also always been very strong in WA.

“In particular, and working to WA's strengths, there is significant crossover between offshore gas and the naval and maritime sector. The transferable skillsets that would allow people involved in the engineering and technical areas of the offshore sector to easily make the transition to defence work.”



140 Crozier, Ry. "Australian miners send drones to work". 2012

141 Shukla Amit and Hamad Karki. 2016. "Application of robotics in offshore oil and gas industry— A review Part II." *Robotics and Autonomous Systems*. Volume 75, Part B, January 2016. pp. 508-524.

142 Shuka and Karki. "Application of robotics in offshore oil and gas industry." 2016.

143 WA Department of Jobs, Tourism, Science and Innovation. "Global resources hub". Accessed October 16, 2017: <http://bit.ly/2gXgA6c>

144 See Appendix A: R&D Expertise of WA Universities.

Key natural synergies between the defence and resources sectors also include the State's large engineering sector with expertise in offshore oil and gas and information technology. Both disciplines possess skills easily transferable to defence industry, and include experience in the development of major resource projects as well as the importance of ongoing maintenance and support. The latter is important given local defence industry's role in new projects as well as sustainment and through-life support.

Several of these resource projects have been multi-billion developments with multiple moving parts. This has also created particular expertise in sophisticated and complicated project management, similar to many large Defence materiel projects. Resource firms are also broadly familiar with the security requirements of large projects that are necessary to contract to Defence. A key challenge, however, is to convince firms normally engaged in the resources sector that they have the capacity to translate their skills into defence materiel projects.

WA hosts the Navy's entire submarine fleet, and with the prevalence of such a large and high-end subsea sector, there are obvious synergies that could, for example, be explored in areas such as underwater communications, engineering and medicine. This enhances the case previously espoused by the Submarine Institute of Australia, and more recently AIDN-WA, for the establishment of a Defence CRC in Undersea Excellence.¹⁴⁵

The proposed centre could be modelled on similar international institutes such as the US Naval Warfare Centre of Excellence in Undersea Technology based at the University of Rhode Island. The centre would ideally be hosted at a university and be founded on public-private partnerships with the relevant industry sectors and Defence agencies,

particularly those with a presence at HMAS *Stirling*, and university research institutes. A review of 'Appendix A: R&D Expertise of WA Universities' demonstrates the wealth of existing research and development capabilities that already resides in WA, particularly in the maritime domain. The synergistic potential here is clearly significant, which the Society for Underwater Technology (SUT), CEO, Steve Hall affirmed:

Australia's offshore oil and gas industry has been pivotal in the development of underwater technologies that are now utilised globally. Central to this has been a Perth-based skill base of subsea scientists and engineers, many of whom are members of the SUT, who have capitalised on the growth of this sector to develop innovative, cost-effective solutions to solve many of industry's needs both with regards to technical advancements and in project delivery. The skill sets acquired are readily transferrable to the Defence industry. For example, synergies between the sectors are evident in activities such as subsea search for lost equipment/assets and their recovery, asset management such as corrosion mitigation, design and routing of subsea cables, and secure data collection and upload. Additionally, technology innovation is core to SUT's purpose and our global membership includes leaders in the development and use of autonomous underwater vehicles and techniques for inspection, survey and discovery, as well as the development of policy, legal guidelines and safe systems of work for robotic and human divers.¹⁴⁶

145 DeSilva-Ranasinghe, Serge. "The Case for WA's Defence Sector" in *The West Australian*, April 27, 2016. p. 22.

146 Personal communication. Steve Hall. CEO Society for Underwater Technology, October 10, 2017.

Aside from harnessing the synergies with the Defence and resources sectors, another area for WA that offers good potential is in C4ISR. As noted in the *2016 Integrated Investment Program*, the Commonwealth has stipulated a funding allocation of 9% or \$22 billion to enhance the ADF's capabilities in this critically important realm. The space and cyber sectors are two areas where WA is recognised nationally and internationally, for both its expertise and infrastructure.

'Appendix B: Defence C4ISR Investment Programs', shows that Defence is strongly focussed on at least 18 significant C4ISR investment programs deemed central to maintaining the ADF's overall effectiveness in an increasingly complex global threat environment.¹⁴⁷ Indeed C4ISR is likely to receive priority attention for many years to come and one area where this is increasingly apparent is in the space sector. Presently, investment and interest in Australia's space sector is at a historic high and this has culminated in the Commonwealth recently pledging to establish a national space agency by 2018.¹⁴⁸ The creation of this agency is likely to have major ramifications for Defence and industry, a message reinforced by Acting Minister for Industry, Innovation and Science, Senator Michaela Cash: "A national space agency will ensure we have a strategic long-term plan that supports the development and application of space technologies and grows out domestic space industry, including through defence space procurement."¹⁴⁹

As illustrated in 'Table 2: Joint Defence Installations in WA', the State already hosts nationally significant C4ISR infrastructure. WA is also host to the Space Situational Awareness Partnership with the US, where a space surveillance C-band radar is jointly operated by both countries. WA is also the site for the relocation of a US optical Space Surveillance Telescope to the Harold E. Holt Naval Communications Station.¹⁵⁰ There are also a number of other Defence modernisation and procurement activities, with multiple related contracts being fulfilled in WA.¹⁵¹

In addition to this infrastructure, as 'Table 17: Civilian Space Infrastructure in Western Australia' points out, WA is already home to civilian space and satellite technology facilities serving a range of needs from international telecommunications, big data analytics to space exploration.

147 FitzGerald, Annaliese. "DWP 2016: the future of C4ISR". *Australian Strategic Policy Institute: The Strategist*. March 4, 2016. Accessed October 14, 2017: <https://www.aspistrategist.org.au/dwp-2016-the-future-of-c4isr/>

148 Sinodinos, Arthur. "Turnbull Government to establish national space agency". September 25, 2017. Accessed November 12, 2017: <http://minister.industry.gov.au/ministers/sinodinos/media-releases/turnbull-government-establish-national-space-agency>

149 Eggleton, Mark. "Space another facet of widening defence industry". *Australian Financial Review*. September 27, 2017. Accessed October 14, 2017: <http://bit.ly/2A4QlQa>

150 FitzGerald, Annaliese. "DWP 2016: the future of C4ISR". 2017.

151 Henry, Caleb. "Australia's military including commercial capacity in its satellite communication plans". *Space News*. May 22, 2017. Accessed October 9, 2017: <http://bit.ly/2A1FyG9>

Table 18: Civilian Space Infrastructure in Western Australia

Infrastructure	Summary
<p>1. Square Kilometer Array Project and Precursor programs</p>	<p>The Mid West Region of WA plays a crucial, yet exciting role in the global Square Kilometer Array Project (SKA) which is a collaborative international effort aimed at building the world's largest radio telescopes over a square kilometer (one million square meters) of collecting area.¹⁵³ The SKA Project is to be jointly hosted at locations in South Africa's Karoo Region and Western Australia's Murchison Shire. It has the backing of 10 member countries and around a further 100 organisations. It is unprecedented in its scale and will eventually use thousands of dishes and up to a million antennas to enable astronomers to monitor the sky and universe in a level of detail never attempted or seen before.¹⁵⁴ The SKA antenna for the project will be built and based at the purpose-built Murchison Radio-Astronomy Observatory (MRO) and will host the required facilities necessary to operate advanced telescopic hardware in this remote region. The MRO also hosts two precursory radio telescopes which are the Australian SKA Pathfinder (ASKAP), and the Murchison Widefield Array (MWA), in order to develop the technology and capabilities to enable the deployment of the SKA in both WA and South Africa.¹⁵⁵</p>
<p>2. Pawsey Supercomputing Centre</p>	<p>The Pawsey Supercomputing Centre is a joint venture between the CSIRO and Perth's four public universities with the support of both the WA and Commonwealth Governments. The centre is supported by \$90 million in funding as part of the Commonwealth Government's National Collaborative Research Infrastructure Strategy. Based at Bentley's Technology Park Precinct, adjacent to Curtin University, the Centre operates multiple supercomputers, data-intensive machines and storage systems that use the most advanced technologies available.¹⁵⁶ Of key interest to the civilian space sector in WA, is Pawsey's partnership with the SKA, whereby the centre will designate two full time equivalent positions to the Science Data Processor Consortium tasked with designing the computing environment used to produce image products from the telescope. The centre itself will use its 'Galaxy' Supercomputer as the real-time processor for the ASKAP to process data from the project's associated Murchison Widefield Array.¹⁵⁷</p>
<p>3. Deep Space Antenna 1</p>	<p>The European Space Agency also has a presence in the Mid West region of WA, hosting the Deep Space Antenna 1 (DSA 1) close to the town of New Norcia, approximately 140km north of Perth. The New Norcia station hosts a 35 meter-long deep space antenna with transmission and reception in both S- and X-band designed for communicating with the agency's various deep space missions. It also provides support to spacecraft such as the Mars Express, Rosetta and Gaia. The DSA antenna also has the distinction of being one of the world's largest for hosting telemetry, tracking and command (TT&C) applications.¹⁵⁸ In 2015, the facility received a new 4.5m radio dish to replace the satellite acquisition capability provided by the agency's former Perth station, that was retired from service in December of that year.¹⁵⁹</p>

152 Square Kilometre Array. "SKA Project". 2017. Accessed October 15, 2017: <https://skatelescope.org/project/>

153 Square Kilometre Array. "SKA Project". 2017.

154 SKA Australia. "Australia's SKA site". 2017. Accessed October 15, 2017: <http://www.ska.gov.au/Observatory/Pages/default.aspx>

155 Pawsey Supercomputing Centre. "About". 2014. Accessed October 15, 2017: <https://www.pawsey.org.au/>

156 Pawsey Supercomputing Centre. "The Square Kilometre Array". Accessed October 15, 2017: <http://bit.ly/2xFcPyV>

157 European Space Agency. "New Norcia – DSA 1". Accessed October 15, 2017: <http://bit.ly/2hrZzOu>

158 European Space Agency. "Perth Station". Accessed October 15, 2017: <http://bit.ly/2z8naNR>

159 Shire of Exmouth. "Learmonth Solar Observatory". Accessed October 15, 2017: <http://bit.ly/2h0Dd9W>

160 Bureau of Meteorology. "Learmonth Observatory Overview". 2017. Accessed October 15, 2017: <http://www.sws.bom.gov.au/Solar/3/1>

161 Nautilus Institute for Security and Sustainability. "Perth International Telecommunications Centre – Landsdale". Accessed October 15, 2017: <http://bit.ly/2h0DlpW>

<p>4. Learmonth Solar Observatory</p>	<p>The Learmonth Solar Observatory, located 34km south of North West Cape town of Exmouth is a long running solar observatory established in April 1979 and jointly operated by the Bureau of Metrology Space Weather Service and the US Air Force. The site hosts a wide range of infrastructure such as a suite of optical telescopes and parabolic dish antennae with the site forming part of a worldwide network that monitors solar activity 24 hours a day at both optical and radio wavelengths. It is in particular tasked with observing the sun from sunrise to sunset daily to report on any unusual occurrences that may impact on human activities both on earth and in space.¹⁶⁰ The facility also has the distinction of hosting one of only six solar velocity imagers in the Global Oscillation Network Group operated by the US National Solar Observatory.¹⁶¹</p>
<p>5. Perth International Telecommunications Centre</p>	<p>The Perth International Telecommunications Centre is located in the north eastern suburb of Landsdale in the City of Wanneroo. The Centre is the host site for downlink and tracking facilities for the both European Space Tracking System and the Japan Aerospace Exploration Agency.¹⁶²</p>

The transferable nature of this civilian expertise and technology will be increasingly sought after by Defence, particularly in relation to satellite communications and imagery. According to the Executive Director of the WA-based International Centre for Radio Astronomy Research (ICRAR), Professor Peter Quinn:

WA has significant capabilities and opportunities that will support the creation and growth of an Australian Space Agency and industry. The skills in radio astronomy technologies and big-data science developed over the past eight years for the SKA at the International Centre for Radio Astronomy Research in Perth, are also key to building space communications and satellite down-link capabilities. Radio telescopes in WA already monitor space weather and track space debris. ICRAR is also working with the European Space Agency (ESA) on plans to expand ESA capacities in WA and allow Australian researchers access to space projects. This expanded relationship could see ESA assist Australian companies to open new commercial opportunities for down-link capacity and space hardware production in WA.¹⁶²

The evidence presented suggests that ongoing policy and advocacy to grow the WA space sector should be a priority for the WA Government. It is therefore necessary for WA to advocate for the growth of the space sector. Advocacy for the establishment of a Commonwealth space agency in Perth is timely and relevant, but it is far from certain whether WA will be the location, as other states and territories have been vocal in their own proposals. There is, however, the potential to further enhance the development of the local space sector in the State, and increase WA's value proposition to the national interest.

Seen from this vantage, WA Premier Mark McGowan's recent comment is timely reminder of the potential of this industry sector: "We're a very good State for these sorts of things because of our wide-open spaces, our lack of interfering radio waves, and the fact we have the Square Kilometre Array here shows that the international science community thinks WA is a good location".¹⁶³

Similarly, another area where WA's strength is nationally and internationally renowned is in the cyber domain. Today, the development of a cyber-enabled warfare capability is a national security priority for Australia, with Defence undergoing a revolutionary transformation.¹⁶⁴

162 Personal communication with International Centre for Radio Astronomy Research, October 9, 2017.

163 The West Australian. "Perth! This is Tranquillity base! We want Australia's space base, says Mark McGowan". September 25, 2017. Accessed October 16, 2017: <http://bit.ly/2hrCz2h>

164 McGhee, Ashlynn. "Cyber warfare unit set to be launched by Australian Defence Forces". ABC News. June 30, 2017. Accessed October 14, 2017: <http://ab.co/2vjij84>

Other than the Australian Signals Directorate (ASD), there are a growing number of cyber-related agencies within Defence. They include:

- The Australian Cyber Security Centre, which coalesces the existing cyber security capabilities across Defence, the Attorney-General's Department, Australian Security Intelligence Organisation, Australian Federal Police and Australian Crime Commission in a single location.¹⁶⁵
- DST Group Cyber and Electronic Warfare Division, which undertakes research and development focused on identifying, analysing and countering threats to Australia's defence and national security through electronic means;¹⁶⁶ and
- The ADF's Information Warfare Division, noting Navy also raised its own Information Warfare Force.

In June this year, the Commonwealth Government recognised ECU as one of just two Academic Centres of Cyber Security Excellence,¹⁶⁷ and subsequently awarded the university a \$50 million NGTF grant to establish a Cyber Security CRC. This has now placed WA as a national focal point for cyber research and capability development.¹⁶⁸ Referring to the announcement, ECU Security Research Institute Director, Professor Craig Valli, stated:

The Cyber Security CRC will work with key government, industry and research groups to strengthen systems and networks and train the next generation of cyber security specialists. Ultimately, this will have benefits for the community who will enjoy an online experience that is more secure. The Cyber Security CRC brings together expertise across six of Australia's leading cyber security universities together with industry and government partners, including the AFP, ATO, Attorney General's Department, CERT, Cisco, Department of Defence, Data61, Tata Consultancy Services, Jemena, ActewAGL and Singtel Optus.¹⁶⁹

'Appendix A: Research and Development Expertise of WA Universities' amply demonstrates ECU's success. It demonstrates ECU as being both an indicator of the overall capabilities of WA's university sector, and that the State's university sector possesses expertise that is both nationally and internationally recognised across a variety of fields, and it is strongly positioned well to benefit from existing Commonwealth funding programs.

To consolidate a culture of innovation and collaboration will require strategic vision and investment if WA is to maintain its competitive edge and be at the forefront of the next generation of Defence technologies. To further harness and accelerate potential in these sectors, the WA Government should look to creating a defence innovation and commercialisation fund to help augment local

165 Australian Cyber Security Centre. "About the Australian Cyber Security Centre". Accessed October 14, 2017: <http://bit.ly/2ij8MZ9>

166 Department of Defence Science and Technology. "Cyber Electronic Warfare Division". 2017. Accessed October 14, 2017: <http://bit.ly/2IAotA7>

167 Edith Cowan University. "ECU to lead \$50m cyber security centre". September 24, 2017. Accessed October 16, 2017: <http://bit.ly/2IAW8tf>

168 Edith Cowan University. "ECU to lead \$50m cyber security centre". 2017.

169 Edith Cowan University. "ECU to lead \$50m cyber security centre". 2017.

SMEs, that are seeking Commonwealth funding through the Defence Innovation Hub and/or, the Next Generation Technology Fund.

The Defence and resources sectors, and the rising profile and importance of C4ISR, is clearly an area that WA can markedly expand within, and should form a key component of the WA and Commonwealth Government's strategy to promote innovation within Defence. In light of this, it is evident that synergistic innovation in WA has an optimistic future, and has significant potential to value add towards new Defence technologies and applications.

4.2 Defence Exports

The Commonwealth Government's *2016 Defence Industry Policy Statement* indicated a renewed focus towards maximising exports for Australian defence industry.¹⁷⁰ Following on the release of the *2016 Defence Industry Policy Statement*, the Minister for Defence Industry, Christopher Pyne, announced a strong push towards Australian defence exports earlier this year.

He explained: "For far too long we have hidden our light under a bushel. (We) thought the Italians do it better, the French do it better, the Germans sell their wares, the British are quite ruthless and the United States are out there. We believe we do make some of the best equipment and platforms in the world today and we want to sell them."¹⁷¹ Further, while Commonwealth agencies are now more appropriately resourced to provide assistance to Australian companies interested in

generating export opportunities, Australia has much to do in order to strengthen its profile as an exporter. It is worth noting that the Australian Military Sales Office within CASG is actually tasked with assisting defence industry to export to foreign government customers.¹⁷²

Nevertheless, by global standards, Australia is a minor defence exporter when compared to the dominant top five players on the global stage: the US, Russia, Germany, France and China.¹⁷³ Between 2011 and 2015, Australia ranked 20th globally for defence exports, and fifth for defence imports during the same period.¹⁷⁴ According to the World Bank, Australia's defence exports between 2010 and 2016 amounted to only \$658 million.¹⁷⁵ However, irrespective of this relatively minimal performance, there is potential for Australia to emerge as a more substantial defence exporter in the decade ahead, particularly by positioning itself to become a shipbuilding and component supplier for countries in the Indian Ocean and the Asia-Pacific regions.

In addition to the Military Sales Office, there are a number of Commonwealth programs and grants that are available to Defence SMEs seeking to export products and services overseas. The CDIC runs the Global Supply Chain Program and Team Defence Australia trade events, which facilitate access to international defence trade shows and briefings.¹⁷⁶ The same program also assists businesses to access global supply chains, and currently provides linkages to the Defence primes BAE, Boeing, Lockheed Martin, Northrop Grumman, Raytheon, Rheinmetall and Thales.¹⁷⁷ By late 2016, the program had

170 Department of Defence. *2016 Defence Industry Policy Statement*. 2016. Accessed October 12, 2017: <http://bit.ly/2zRRn0Y>. p. 11.

171 McMahon, Amelia. "Defence industry pushes for more Australian exports". *Defence Connect*. February 9, 2017. Accessed October 12, 2017: <http://bit.ly/2z2gpey>

172 Department of Defence. "Australian Military Sales Office". Accessed October 12, 2017: <http://bit.ly/2z7LMpT>

173 Aljazeera. "The 10 countries that export the most major weapons". February 22, 2017. Accessed October 12, 2017: <http://bit.ly/2zONBFx>

174 McMahon, Amelia. "Defence industry pushes for more Australian exports". 2017.

175 The World Bank. "Arms Exports Australia (SIPRI trend Indicator Values)". Accessed October 12, 2017: <http://bit.ly/2hrRMA9>

176 Australian Government. "International and Export Support". January 5, 2017. Accessed October 9, 2017: <http://bit.ly/2z8YLaT>; Department of Defence. *2016 Defence Industry Policy Statement*. 2016. Accessed October 12, 2017: <http://bit.ly/2zRRn0Y>. p.70.

177 Australian Government. "International and Export Support". 2017.

provided over 1,000 commercial opportunities to Australian industry, and more than 115 Australian firms have secured upwards of 700 contracts that were cumulatively worth over \$755 million.¹⁷⁸

A major Commonwealth export initiative is the Export Market Development Grant (EMDG) program delivered through Austrade. The EMDG provides grants to companies with a turnover of under \$50 million to cover 50% of their export promotion costs up to a total value of \$150,000.¹⁷⁹ The advantage of this grant program is that it is not competitive, and any business which meets eligibility requirements will receive funding.¹⁸⁰ Similarly, another key Commonwealth agency is the Export Finance and Insurance Corporation (Efic), which is an export credit agency, operating as a commercial entity that provides export finance, and insurance services, for Australian exporters.¹⁸¹

The Office of Defence West, provides another mechanism for local industry to leverage existing State-based trade offices to support defence industry efforts to forge new opportunities in overseas markets. Equally important is that the Office has pledged to establish a biennial Indian Ocean defence trade show in Perth from late 2018, to promote the capabilities of WA-based defence industry and foster export opportunities.

Indeed, as recently identified by the Office, WA is strategically positioned to grow its

export market by attracting US Navy and other allied warships to visit the State. The increasing number of visits by US warships has the potential to provide new opportunities for minor sustainment work and logistical support. For example, between 1990 and 2003, over 164,000 US Navy personnel transited through Perth, and injected more than \$107 million into the local economy.¹⁸² When the US Navy's Abraham Lincoln carrier group visited Perth for just a five-day respite, the WA economy received more than \$14 million in direct income.¹⁸³

The most advantageous export area for defence industry in WA is clearly in the naval and maritime sector emphasising a proven track record of success in shipbuilding. In comparison to other Australian states, WA is a high performing defence exporter, primarily due to Australia's most significant shipbuilder, Austal Australia, also being the largest defence exporter in the country.¹⁸⁴ Across both civilian and defence markets, Austal's record of export success is demonstrated by the fact that it has sold more than 255 ships to 100 customers in 44 countries.¹⁸⁵ Approximately 80% of total production of vessels, both civilian and military, is destined for export markets such as the Asia, Europe, Middle East and the US.¹⁸⁶

In the naval and maritime sphere, between 2003 and 2014 Austal Australia built and sold up to 26 vessels to six countries around the world, ranging from patrol craft to high-speed support vessels.¹⁸⁷ In addition, since 2005

178 Department of Defence. *2016 Defence Industry Policy Statement*. 2016. Accessed October 12, 2017: <http://bit.ly/2zRRn0Y>. p. 50.

179 Australian Trade and Investment Commission. "What is EMDG?". Accessed October 9, 2017: <http://bit.ly/2A4eQwy>

180 Australian Trade and Investment Commission. "Who Can Apply". Accessed October 9, 2017: <http://bit.ly/2z1NMR1>

181 Export Finance and Insurance Corporation. "About EFIC". Accessed October 9, 2017: <https://www.efic.gov.au/about-efic/>; Export Finance and Insurance Corporation. "Our products". Accessed October 9, 2017: <http://bit.ly/2hs84cy>

182 Government of Western Australia. "Sea Swap to boost local economy". January 19, 2003. Accessed October 9, 2017: <http://bit.ly/2A57Uj4>

183 Government of Western Australia. "Sea Swap to boost local economy". 2003.

184 Austal. "Austal Continues Export Success with US Navy Contract for LCS30". October 8, 2017. Accessed October 12, 2017: <http://bit.ly/2zWu5ai>

185 Personal communication. Paul Sparke, Marketing Manager, Austal, October 2, 2017. See also Austal. "Austal and ASC Shipbuilding Join Forces to Support Government's National Shipbuilding Endeavour". June 7, 2017. Accessed October 9, 2017: <http://bit.ly/2z2Z58Y>

186 Personal communication with Paul Sparke, Marketing Manager, Austal, October 2, 2017.

187 These include the Kuwait Coast Guard, Yemeni Navy, Bermuda Police, Trinidad and Tobago Coast Guard, Armed Forces of Malta and Royal Navy of Oman.

Austal USA has been fulfilling a substantial order for the US Navy comprising 14 Littoral Combat Ships (LCSs) and 12 Expeditionary Fast Transports (EFTs) that have either been delivered, are under construction or are scheduled.¹⁸⁸ In fact, following the completion of the planned LCS program comprising 52 ships, of which Austal will supply 26, and the EFT program composed of 12 vessels, Austal claims that it will have delivered approximately 15% of the US Navy's current surface fleet.¹⁸⁹

There are also opportunities to export smaller in-shore patrol vessels for foreign police and paramilitary forces, which would leverage off the experience and efficiency of local small boat builders. For example, in 2011, then Fremantle-based Thornycroft Maritime and Associates Australia secured a \$25 million contract to manufacture coastal surveillance patrol boats for the Indonesian National Police, utilising a design developed by another WA-based company, Sherwood Marine Design.¹⁹⁰ However, opportunities also extend beyond the provision of the initial platform, as many contracts also require communications systems, engines, C4ISR technology, training and sustainment support. There are at least another 15 significant WA-based suppliers and SMEs that have succeeded in generating defence export outcomes.

They include:

- Barrett Communications;
- Blacktree Technology;
- Calytrix Technologies;
- Composite Components;
- Fastwave Communications;
- Geng;
- Hawker Pacific;
- Hofmann Engineering;
- Marathon Targets;
- Orbital Engineering;
- Secure Systems;
- Takor Group;
- VEEM;
- Western Australia Specialty Alloys; and
- Winchester Global.¹⁹¹

WA industry is positioned to capitalise on opportunities in the Indian Ocean and the Asia-Pacific regions due to advantages in geographical and time-zone proximity, not available to the east coast of Australia or distant European and North American suppliers. Countries in the Indian Ocean region have also been increasing their defence spending as a percentage of GDP.

In 2016, salient examples included Oman, the world's largest defence spender, with 13.73% of GDP being spent on defence.¹⁹² Following closely behind is Saudi Arabia at 9.85% of GDP spent on defence.¹⁹³ Although India's percentage of defence expenditure to GDP reached 2.47% in 2016, its demand for military equipment, particularly between 2012-16, ranked it as the world's largest arms importer constituting 13% of total global arms sales.¹⁹⁴ In 2016 Southeast Asian countries, six

188 Personal communication. Paul Sparke, 2017.

189 Personal communication . Paul Sparke, 2017.

190 TFR Review. "ANZ and EFIC support Thornycroft's \$25m Indonesian police contract". March 29, 2011. Accessed October 9, 2017: <http://bit.ly/2z2q7O5>; Sherwood Marine Design. "11.5m Patrol Boat". Accessed October 9, 2017: <http://bit.ly/2z83j1x>

191 For further details see Section 3: *Capabilities of Defence Industry*.

192 Central Intelligence Agency. "Country Profile - Oman". *The World Factbook*. October 4, 2017. Accessed October 12, 2017: <http://bit.ly/2z0QJBp>

193 Central Intelligence Agency. "Country Profile – Saudi Arabia". October 4, 2017. Accessed October 12, 2017: <http://bit.ly/2zm2Mdg>

194 Central Intelligence Agency. "Country Profile – India". October 4, 2017. Accessed October 12, 2017: <http://bit.ly/2yiq9UI> ; Rajagopal, Divya. "India world's largest importer of major arms in the last four years". *The Economic Times (India Times)*. February 20, 2017. Accessed October 12, 2017: <http://bit.ly/2gQldu7>

of which are Indian Ocean littoral states, spent a combined total of nearly \$41.9 billion on Defence, with much of this spent on imported equipment.¹⁹⁵

While there are considerable opportunities, it is important to note that Australian defence-related exports are regulated through the Defence Export Control Branch in Defence, which provides guidance to defence industry and ensures compliance with a wide array of domestic and international regulations.¹⁹⁶

From a practical perspective, what prospective exporters need to be aware of is the Defence Strategic Goods List.¹⁹⁷ The list is extensive and covers not only munitions and military materiel, but ‘dual-use’ equipment.¹⁹⁸ The list is regularly updated and any product or service which falls under the list requires the exporting company in question to lodge a formal application to receive Commonwealth approval.

In the first three quarters of FY2016-17, the Defence Export Control Branch finalised 2,766 applications, out of which 195 were either

Table 19: Export Permits Issued to End Users (By Continent) By Financial Years

	FY 2014-15	FY 2015-16	FY 2016-17 1st Quarter	FY 2016-17 2nd Quarter	FY 2016-17 3rd Quarter
Asia	21%	20%	19%	17%	18%
Australia	24%	22%	22%	27%	19%
North America	17%	19%	19%	19%	20%
Oceania	19%	17%	17%	17%	22%
Europe	13%	14%	14%	14%	13%
Africa	4%	4%	4%	4%	5%
South America	1%	2%	2%	1%	2%
Other	1%	1%	1%	1%	0%

Source: “Defence Export Control Statistics 2016/17”. Accessed October 16, 2017: <http://www.defence.gov.au/ExportControls/Statistics.asp>

195 . Nan Tian, Aude Fleurant, Pieter Wezeman and Siemon Wezeman. “Trends in World Military Expenditure, 2016”. *Stockholm International Peace Research Institute*. April 2017. Accessed October 12, 2017: <http://bit.ly/2zmx6Ew> p. 5. Table :

196 Defence exports includes both munitions and clear military materiel and components as well ‘dual-use’ products which fall under the Commonwealth Government’s Defence and Strategic Goods List, which is restricted and controlled under Australian and international law. Dual-use products are those which are developed for civilian use, but which can have military application. See also Department of Defence. “Defence Export Controls”. Accessed October 9, 2017: <http://www.defence.gov.au/ExportControls/Links.asp>

197 The List comprises 10 categories: nuclear materials, facilities and equipment, materials, chemicals, microorganisms and toxins, materials Processing, electronics, computers, telecommunications and information security, sensors and lasers, navigation and avionics, marine, aerospace and propulsion. See Federal Registrar of Legislation. “Defence and Strategic Goods List”. November 15, 2016. Accessed October 9, 2017: <https://www.legislation.gov.au/Details/F2016C00970>

198 Federal Registrar of Legislation. “Defence and Strategic Goods List”. 2016.

withdrawn, made inactive, or had lapsed, and 84 denied or prohibited.¹⁹⁹ The Branch endeavours to turn around applications in a prompt manner, and appears to do so. For example, in FY2016-17 95% of non-sensitive applications were assessed within 15 days, and 92.7% of sensitive or complex applications were assessed within 35 days.²⁰⁰

The data presented in Table 17 shows that Australian defence exports have changed very little in recent years. Nonetheless, it is important to note the importance of Australian-based subsidiaries of the large US and European defence firms in generating export capacity. For instance, the Australian subsidiary of French Defence prime Thales, has had export sales of the Australian-manufactured Bushmaster Protected Mobility Vehicle to the Defence forces of Japan, the Netherlands and the United Kingdom.²⁰¹

Rockwell Collins Australia, which manufactures optical assemblies for the F-35 JSF key electro-optic distributed aperture system, has plans to produce more than 7,000 assembly units across the lifespan of the F-35 JSF program, representing around 40% of global production.²⁰² Another prime example is the WA-based firm WASA, which manufactures components for the global F-35 JSF program.

These figures indicate that while Australian and WA companies have had some recent export wins, the defence export market remains relatively untapped. Despite the rigour over exporting defence or dual-use products and services, the export processes can hardly

be considered excessively onerous. Successes to date, including from WA, and reinvigorated Commonwealth support for Australia to expand its defence exports, provides a good opportunity for WA-based firms in international markets.

199 Department of Defence. "Defence Export Control Statistics 2016/17". Accessed October 9, 2017: <http://bit.ly/2iPyUPi>

200 Department of Defence. "Defence Export Control Statistics 2016/17".

201 Brown, James. "Australian defence exports: Beyond Bushmaster". *Lowy Institute*. May 20, 2014. Accessed October 9, 2017: <http://bit.ly/2znZohG>

202 Pyne, Christopher. "Australia celebrates manufacturing milestone for global F-35 Joint Strike Fighter Program". *Department of Defence*. April 27, 2017. Accessed October 9, 2017: <http://bit.ly/2zVOKet>

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Section 5

Additional Potential
for Defence and
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Section 5:

Additional Potential for Defence and Defence Industry

In addition to a well-developed and advanced defence sector with strong future prospects for innovation and collaboration, there are further opportunities through which WA's value proposition to Defence, and Australia's strategic interests, could be markedly enhanced. The following sections highlight three selected examples, emphasising Indigenous engagement, the establishment of an Indian Ocean Patrol Boat Program and the expansion of the Army in the West, all of which espouse veritable and untapped potential for both Defence, and the defence industry.

5.1 Defence and Indigenous Employment

Firstly, increased interest, by the Commonwealth and Defence towards increasing Indigenous engagement and reducing Indigenous disadvantage, provide significant opportunities to generate employment for Indigenous Australians in Defence and the defence industry. Similarly, the prospect of generating employment and training opportunities, as well as commercial outcomes for Indigenous-owned businesses, remains a largely untapped area in WA.

According to the Australian Bureau of Statistics, in 2016, the total Indigenous population in Australia was estimated at 649,171.²⁰³ WA has the fourth-largest Indigenous population by state, which accounts for 11.7% or 75,978 people of the national total,²⁰⁴ and this equates to 3.1% of the State's total population.²⁰⁵ Of this, 41% of Indigenous people in WA live in the greater Perth area,

while the other 58% reside in regional and remote areas of the State.²⁰⁶ As a community that suffers from high rates of unemployment, particularly youth unemployment, the gathering momentum within Defence and the defence industry to engage Indigenous Australians, and their businesses, offers new and enhanced opportunities for WA-based Indigenous communities to capitalise on.

Not least, and as part of the Commonwealth Government's Closing the Gap initiative, Defence is uniquely placed to provide full-time or part-time employment opportunities for Indigenous Australians. For many years, the ADF has actively engaged in increasing Indigenous participation. As a key example, the Army is presently engaged in a major recruitment drive to achieve 5% Indigenous representation by 2025.²⁰⁷ Presently, there are 748 Indigenous personnel, or 2.5%, serving

203 Australian Bureau of Statistics. "Census of Population and Housing – Counts of Aboriginal and Torres Strait Islander People". August 31, 2017. Accessed September 27, 2017: <http://bit.ly/2yiw6Rd>

204 Australian Bureau of Statistics. "Census of Population and Housing – Counts of Aboriginal and Torres Strait Islander People". 2017.

205 Australian Bureau of Statistics. "Census of Population and Housing – Counts of Aboriginal and Torres Strait Islander People". 2017.

206 Australian Bureau of Statistics. "Census of Population and Housing – Counts of Aboriginal and Torres Strait Islander People". 2017.

207 Campbell, Angus. "Chief of Army Address to the Defence Force Recruiting Conference". August 04, 2016. Accessed October 8, 2017: <http://bit.ly/2gQe1PA> See also Australian Army. "Army Indigenous Strategy". August 30, 2017. Accessed October 8, 2017: <http://bit.ly/2h4gSbr>

in the Regular Army, which represents an increase of 1.4% since 2007.²⁰⁸

The ADF operates a number of Indigenous recruitment and training programs that are aimed specifically at enhancing Indigenous participation. For instance, Air Force runs an Indigenous Undergraduate Scheme that provides opportunities for university sponsorship with follow on Air Force employment.²⁰⁹ The Army and Navy respectively undertake their own programs. The Navy orchestrates the Defence Indigenous Development Program (DIDP), while the Army runs its equivalent Army Indigenous Development Program (AIDP).²¹⁰ Finally, Defence runs the Indigenous Pre-Recruit Program (IPRP), which seeks to attract Indigenous candidates nationwide into careers across the ADF.²¹¹

The DIDP, which is Navy focussed, and the AIDP, are both essentially similarly structured programs, but run by different force arms of the ADF. The DIDP/AIDP residential courses are five and half months in duration and designed for young Indigenous Australians who seek a career in the ADF, but are challenged in meeting the literacy, medical and fitness entry standards. Similarly, the IPRP is a six-week program for school leavers, which aims to assist young Indigenous people who may not meet regular admittance standards, but are afforded the opportunity through this intensive program. The course focuses on physical fitness, character development and enhancement of knowledge required for a candidate to prepare for an ADF career.²¹²

At present, WA does not currently host these courses because historically the majority of Indigenous recruits into the ADF come from the eastern states. The establishment of either one or more, or another variant, of these programs in WA would encourage greater participation from the State's Indigenous community, including Aboriginal people from rural and remote areas. The move to establish these programs in the West has received strong support from several Indigenous elders, as exemplified by the President of the Aboriginal and Torres Strait Islander Veterans and Services Association of WA, Di Ryder, who commented:

As an ex-serving Army member with 21 years of service, I fully support the initiative to establish and upgrade Defence recruitment and integration programs in WA to markedly increase local Indigenous participation in the ADF. As a Noongar Elder, joining the Army has helped me to achieve so many things in my life such as my recent award of the National NAIDOC 2017 Lifetime Achievement Award. There is no question that the foundation underpinning my career achievements is because of the training, self-discipline, support and much more, that I received during my time in the Army. I shall fully support these initiatives, and will continue to positively promote them throughout my community.²¹³

208 Personal communication, Brigadier Mark Brewer, Commandant, Royal Military College, June 28, 2017.

209 Royal Australian Air Force. "Diversity in the Air Force". Accessed October 8, 2017: <http://bit.ly/2z2Hw9b>

210 Department of Defence. "Defence Indigenous Development Program - Navy and Army Indigenous Development Program" Accessed October 13, 2017: <http://bit.ly/2ijxitk>

211 Department of Defence. "Indigenous Pre Recruit Program". Accessed October 23, 2017: <http://www.defence.gov.au/Diversity/Indigenous/career/ADF/iprc.asp>

212 Department of Defence. "Defence Indigenous Development Program - Navy and Army Indigenous Development Program". 2017.

213 Di Ryder is the recipient of 1990 Australia Day Medallion, Perth NAIDOC 2009 Outstanding Achievement Award, City of Swan 2009 Active Citizenship Award and was nominated in 2015 for Australian of the Year. Personal communication. Di Ryder, President, Aboriginal and Torres Strait Islander Veterans and Services Association of WA, October 3, 2017.

Part-time career opportunities are also an option. In WA, the Army Reserve is another potential employment and vocational training stream for Indigenous Australians that remains untapped. The 13th Brigade is one of three Army Reserve units in WA that could provide Indigenous Australians with part-time employment and the opportunity to gain and develop vocational skills.²¹⁴ The Brigade's area of responsibility is spread over a wide area with depots located across regional WA, such as Albany, Bunbury and Kalgoorlie, and therefore is accessible to some rural Indigenous communities.²¹⁵

For Indigenous people living in the remote North West region, there are opportunities to join the Army's two reserve units stationed in the North West. WA is the only State in Australia to have two Regional Force Surveillance Units (RFSUs). They include the famed Pilbara Regiment, which is the only Australian Army unit to use Aboriginal words (*Mintu Wanta*, Always Alert) in its unit crest, and the Kimberley Squadron of NORFORCE. Historically, the Indigenous composition of the Pilbara Regiment²¹⁶ and the Kimberley Squadron of NORFORCE²¹⁷ has remained low, although this has not been the overall case for NORFORCE, with 60% of the unit composed of Indigenous Australians.²¹⁸ Being RFSUs, both units have a strong mandate to regularly engage with the region's scattered Indigenous communities. It is therefore evident that Indigenous Australians who succeed in joining the Army Reserve in WA are afforded an opportunity to access vocational training and develop skills that are also transferable to the civilian workforce.

The ADF Cadets in WA offer a conduit for vocational training opportunities for teenage Indigenous Australians. Presently in WA,

ADF Cadets number over 2,000 cadets and staff, with 55 Cadet units or depots located throughout the State (11 Navy, 28 Army and 16 Air Force).²¹⁹ Again, increasing the participation of Indigenous Australians in the Defence Force Cadets would provide clear developmental benefits that could not only position cadets for a career in Defence, but provide a stronger foundation for their personal and career development. Voicing endorsement of increasing ADF Indigenous engagement, particularly in the remote North West, former senator and Defence Minister, David Johnston, said:

The vast extent of the coastline in the North West of WA, together with the capacity and skills which Aboriginal people possess, presents a unique opportunity for detailed and focussed intelligence gathering, surveillance and reconnaissance, as is now carried out by the Pilbara Regiment and NORFORCE. Given the enhanced mobility and highly developed technological capability of people smugglers, drug smugglers, poachers and illegal fishers, the expansion of Indigenous and remote region units is the obvious response to these growing and serious threats. The ADF has the resources to impart education and training such that a rotation as a regular ADF member, or a reservist, goes a long way to meeting the twin objectives of further development of Indigenous skills and capacity. At the same time this provides a sound basis for protection and reconnaissance over some of the most remote regions of our country.²²⁰

214 At present, out of an overall strength of around 1,200 personnel, there are 10 Indigenous personnel in the ranks of the 13th Brigade.

215 Australian Army. "13th Brigade". December 5, 2016. Accessed October 8, 2017: <http://bit.ly/2xluRqH>

216 The Pilbara Regiment presently has 15 Indigenous personnel in its ranks.

217 The Kimberley Squadron of NORFORCE is currently composed of four Indigenous personnel.

218 Australian Army. "North West Mobile Force". December 14, 2016. Accessed September 5, 2017: <http://bit.ly/2z2X8Mf>

219 Personal communication. Lieutenant Colonel Rogan Aitken, Deputy Commander, WA Australian Army Cadets, July 11, 2017.

220 Personal communication. David Johnston, October 3, 2017.

Furthermore, both Defence and defence industry have a key role in helping to bridge the gap in Indigenous disadvantage by engaging Indigenous-owned businesses. Defence is also bound by the 2015 Commonwealth Government's Indigenous Procurement Policy (IPP), which outlined the Commonwealth's target of achieving 3% of Government procurement from Indigenous enterprises. Since then, in FY2016-17, according to the Defence Estate and Infrastructure Group, 25 Indigenous-owned companies nationally won Defence estate related project work worth \$86m.²²¹

Enterprises such as Indigenous Defence Consortium, a national organisation that lobbies on behalf of its Supply Nation-certified²²² Indigenous-owned member businesses, aims to increase the proportion of Defence procurement from Indigenous enterprises Australia-wide.²²³ An outstanding case in point among Indigenous-owned businesses is National Aboriginal Construction Partners Projects, which in November 2016 was awarded a \$10 million Defence contract.²²⁴

Another example is Pacific Services Group Holdings, which won a tender as the lead contractor on a refurbishment of HMAS *Waterhen*, and a contract for works at RAAF *Base Wagga* worth over \$6 million.²²⁵ According to the Directory for WA Indigenous Businesses there are between 370-440 registered Indigenous-owned businesses in the State.²²⁶ This suggests that there is clearly

“in FY2016-17, according to the Defence Estate and Infrastructure Group, 25 Indigenous-owned companies nationally won Defence estate related project work worth \$86m ”



potential for Indigenous-owned enterprises in WA to enter the Defence supply chain.

Defence industry also has a role to play in bridging the gap in Indigenous disadvantage. This can be carried out by offering employment opportunities to Indigenous Australians and engaging Indigenous-owned contractors, and also by offering Indigenous apprenticeship and intern programs. Companies that have led the way in Indigenous employment initiatives in defence industry include Broadspectrum, which has pledged to expand its Indigenous workforce from 4.5% to 6.5% by 2018 and bolster procurement of Indigenous sub-contractors and suppliers to 3% by 2020.²²⁷ More recently, other Defence companies, such as Naval Group,²²⁸ BAE Systems,²²⁹ and ASC²³⁰ have signed agreements with the Indigenous

221 Personal communication. Gavin Nicholls, Director Estate and Facilities Services, Estate and Infrastructure Group, August 1, 2017.

222 Supply Nation. "The Australian leader in Indigenous supplier diversity". 2017. Accessed October 8, 2017: <http://www.supplynation.org.au/>

223 Indigenous Defence Consortium. "IDC Delivering Capability". 2016. Accessed September 5, 2017: <http://www.idefcon.com.au/>

224 Edwards, Verity. "National Aboriginal Construction Partners wins \$10m Defence contract". *The Australian*. November 12, 2016. Accessed September 5, 2017: <http://bit.ly/2A3I7aF>

225 Pacific Services Group Holdings. "Pacific Services Group Review". 2015. Accessed September 5, 2017: <https://nswicc.com.au/uploads/public/54c/b16/c31/54cb16c3125c4175917084.pdf>. p.14.

226 Aboriginal Business Directory WA. "Directory Search". Accessed September 07, 2017: <http://bit.ly/2zVgm3o>

227 Broadspectrum. "Indigenous Participation". Accessed September 5, 2017: <http://www.broadspectrum.com/esg/indigenous-participation>

228 Naval Group. "DCNS Announces Partnership with Indigenous Defence Consortium". November 23, 2016. Accessed September 5, 2017: <http://bit.ly/2z4rtHY>

229 BAE Systems. "BAE Systems welcomes new indigenous partnerships". May 31, 2017. Accessed September 05, 2017: <http://bit.ly/2z23Pyr>

230 Australian Shipbuilding Corporation. "ASC supply chain opportunities supporting indigenous business growth". June 29, 2017. Accessed September 5, 2017: <http://bit.ly/2z24j59>

Defence Consortium to demonstrate a commitment to providing opportunities to Indigenous Australians. All of these companies, except Naval Group, currently have a profile in WA.

5.2 The Case for an Indian Ocean Patrol Boat Program

A second opportunity for WA lies in developing, and hosting, an Indian Ocean Patrol Boat Program. As an island-continent and country that borders three oceans, Australia has historically played a constructive role in enhancing regional maritime security by assisting developing countries through aid and development programs, as well as through Defence diplomacy. One such initiative that has had a significant impact is the Pacific Patrol Boat Program administered by Defence. This program serves as a possible model that could be replicated in the Indian Ocean region, as a means of enhancing Australia's regional profile, contributing to regional stability, and generating more work for defence industry.

The Pacific Patrol Boat Program commenced in 1987, and has since led to dozens of patrol boats being produced locally, and gifted specifically for use by South Pacific countries, with Australian Navy advisors providing technical and training support as part of the program. The initiative has fostered the nascent maritime policing capabilities of recipient countries, and has had a measurable impact upon safeguarding their sovereignty, and capability to monitor their territorial waters and exclusive economic zones.²³¹

This has enabled more effective fisheries quarantine enforcement, search and rescue, disaster relief, medical evacuation support, and general law enforcement.²³² The success

“The program’s consistently positive track record places it as a model that could be replicated and implemented in the more volatile Indian Ocean region.”



of the program has been acknowledged as having enabled Australia to strengthen its regional influence, particularly through the people-to-people linkages developed through the ongoing presence of Australian Navy and Defence advisers and attachés.²³³ As such, in May 2016, the Program's replacement component valued at \$304 million was awarded to Austal,²³⁴ and will result in the construction of 19 new patrol boats between 2018 and 2023, that will be gifted to 13 Pacific countries.²³⁵

The program's consistently positive track record places it as a model that could be replicated and implemented in the more volatile Indian Ocean region. Over the last two decades, Australia's profile, and military, diplomatic and economic interests in the Indian Ocean region, have seen a manifold increase. This is partly the case because instability in the Indian Ocean region has the potential to seriously affect Australian interests both directly and indirectly.

231 “The Pacific Patrol Boat Project.” *Semaphore*. Issue 2. February 2005. Accessed October 8, 2017: <http://bit.ly/2imk9PQ>

232 Nautilus Institute. “Pacific Patrol Boat Program”. August 24, 2009. Accessed September 4, 2017: <http://bit.ly/2gRH7y1>

233 Bateman, Sam and Anthony Bergin. “Pacific Patrol Boat Replacement Needs Attention.” *The Australian*. May 31, 2011. Accessed October 8, 2017: <http://bit.ly/2ht3fQc>

234 Austal. “Austal Awarded Pacific Patrol Boat Contract”. May 5, 2016. Accessed October 9, 2017: <http://bit.ly/2hsCT0r>

235 Austal. “Austal Awarded Pacific Patrol Boat Contract”. 2016.

This may explain why there have been 65 Australian Navy vessel rotations to the Middle East region since 1990, and that since 2010, the Navy has on six occasions led Combined Task Force 150, responsible for counter-terrorism operations in the Arabian Sea.²³⁶ Another salient example is the influx of unauthorised arrivals from Afghanistan, Iran, Somalia and Sri Lanka using Indian Ocean smuggling routes. In 2013, the crisis surrounding Sri Lankan unauthorised boat arrivals led the Commonwealth Government to gift two aging Armidale patrol boats to Sri Lanka to enhance its capacity at maritime surveillance and interdiction.²³⁷

People smuggling is not the only issue of concern. Today, Indian Ocean fisheries amount to nearly 11.5 million tons or 15% of the world's total wild-catch.²³⁸ Regional stability through effective fisheries management has also become a strategic issue and, in some instances, has dramatically escalated tensions between states.²³⁹ The increasing occurrence of Illegal, Unreported, and Unregulated (IUU) fishing, is a matter of serious and growing concern for Indian Ocean littoral states. A recent study estimated that 18% of catch in the western Indian Ocean, and 32% in the eastern Indian Ocean, was categorised as IUU fishing.²⁴⁰

As it is a region that sustains abundant fisheries, both historically and contemporarily,

littoral and island states of the Indian Ocean region have relied heavily on fish as a staple of their diet. In recent years, this reliance has increased further, with large and growing populations to feed. Among some South Asian countries, marine fisheries is a strategic sector that sustains economic and food security. As the most populated country in the Indian Ocean region, India has a substantial fisheries sector that provides employment to four million people,²⁴¹ which annually accounts for 20% of its agricultural exports, and 10% of its total exports.²⁴² For FY2014-15, India accounted for an estimated total output of 9.58 million tons of fish, making it the world's second-largest fish producing country, after China.²⁴³

Pakistan has a fisheries workforce of nearly 400,000 people, with an additional 600,000 people who indirectly derive a livelihood from it.²⁴⁴ Sri Lanka's Ministry of Fisheries and Aquatic Resources Development recently claimed that per capita fish consumption throughout the island had increased from 41.3g in 2013 to 46.7g in 2016,²⁴⁵ and accounts for 1.8% of GDP, employing over 270,000 workers, and a further one million people who are dependent on fisheries-related income.²⁴⁶ Finally, the Maldives has between 25-40,000 people directly reliant on fishing as a livelihood.²⁴⁷

236 Email correspondence. Defence Media, September 26, 2017.

237 ABC News. "Tony Abbott confirms Bay Class Patrol Boats gift to Sri Lanka to combat people smuggling". November 17, 2013. Accessed October 13, 2017: <http://www.abc.net.au/news/2013-11-17/abbott-confirms-sri-lanka-boats-deal/5097580>

238 Jaishankar, Druvha. "Indian Ocean Region: A Pivot for India's Growth." *Brookings Institute Blog*. September 12, 2016. Accessed October 8, 2017: <https://www.brookings.edu/opinions/indian-ocean-region-a-pivot-for-indias-growth/>

239 National Intelligence Council. *The Future of Indian Ocean and South China Sea Fisheries: Implications for the United States*. July 30, 2013. Accessed October 8, 2017: <http://bit.ly/2hswX7S> p. iii.

240 Secure Fisheries. "Reducing IUU Fishing in the Western Indian Ocean". Accessed September 4, 2017: <http://bit.ly/2gSHYid>

241 International Collective in Support of Fish workers. "Fisheries and Fishing Communities in India". 2017. Accessed October 8, 2017: <https://indianfisheries.icsf.net/>

242 Indian National Fisheries Development Board. "About Indian Fisheries". Accessed October 8, 2017: <http://bit.ly/2zYUgWR>

243 Hayes, David. "India Looks to Raise Marine Fisheries Production." *World Fishing and Aquaculture*. August 04, 2016. Accessed October 8, 2017: <http://bit.ly/2lCeDhd>

244 Ebrahim, Zofeen T. "Inside Pakistan's Untapped Fishing Industry." *Dawn*. November 5, 2014. Accessed October 8, 2017: <http://bit.ly/2iT8gF1>

245 Colombo Page. "Sri Lanka's per capita fish consumption rises due to bountiful harvest". December 6, 2016. Accessed September 4, 2017: <http://bit.ly/2gSaGQO>

246 Sri Lanka Ministry of Fisheries and Aquatic Resources Development. "Statistics - Fisheries in Sri Lanka". April 9, 2017. Accessed September 4, 2017: <http://www.fisheries.gov.lk/content.php?cnid=ststc>

247 DeSilva-Ranasinghe Serge, and Sutton, Mitchell. "Challenge for Maldivian Coast Guard: Indian Ocean Security". Australian Naval Institute. March 27, 2015. Accessed September 4, 2017: <http://bit.ly/2xJTEuw>

In Africa, Tanzania is one of the largest fish producers on the continent, with over four million people directly and indirectly employed in the industry, although only 14% of fish come from the marine domain.²⁴⁸ Similarly, the fisheries sector in the archipelagic-state of the Comoros accounts for 8% of GDP,²⁴⁹ while Madagascar's fishing industry provides a livelihood for over 193,000 people.²⁵⁰

Seychelles has 40% of its national economy reliant on fisheries,²⁵¹ and Mauritius, while consuming 90% of its catch domestically,²⁵² still exports fish and stakes a claim as third in ranking among exporting states of canned tuna to the European Union.²⁵³ With such significant populations and economies dependent on marine fisheries, the issue of fisheries protection and management is only likely to become increasingly problematic with the added challenge of the environmental implications of climate change.

Similarly, piracy, which has plagued the Horn of Africa and the western Indian Ocean, remains an ongoing concern, although this has significantly reduced in recent years.²⁵⁴ *The State of Maritime Piracy 2016*, found that:

- Decreased vigilance and deterrence in high risk areas is providing pirate networks with the opportunity to attack vulnerable vessels, especially off the Horn of Africa.
- The total cost of counter-piracy operations in the Western Indian Ocean has steadied out at around \$1.5 billion.

- As coalition forces have ended or decreased their commitments in the Middle East Area of Operations (MEAO), independent deployments from various countries such as China, India and Japan now account for the majority of days on station with relation to naval counter-piracy operations.²⁵⁵

“Since 2014, Australian warships have seized 24 shipments of heroin weighing around 6,000kg, and seven shipments of hashish weighing about 18,200kg.”



The Indian Ocean is also a major transit route for narcotics trafficking from the Golden Crescent (Afghanistan, Iran and Pakistan), and the Golden Triangle (Myanmar and Thailand). In 2016, the United Nations Office on Drugs and Crime confirmed that the incidence of heroin trafficking in the Indian Ocean region is rising. In fact, between 2013-2016, the

248 United Republic Tanzania Ministry of Agriculture, Livestock and Fisheries. *The Tanzanian Fisheries Sector: Challenges and Opportunities*. September 2016. Accessed September 27, 2017: <http://bit.ly/2A5IHGb>. p.1,4.

249 Food and Agriculture Organisation of the United Nations. “Fisheries in the ESA-IO Region: Profiles and Trends – Comoros”. 2014. Accessed September 27, 2017: <http://www.fao.org/3/a-br790e.pdf>. P.18.

250 Food and Agriculture Organisation of the United Nations. “Fishery and Aquaculture Country Profiles – The Republic of Madagascar”. 2008. Accessed September 27, 2017: <http://www.fao.org/fishery/facp/MDG/en#pageSection2> p. 18.

251 DeSilva-Ranasinghe Serge; Sutton, Mitchell; and Dempsey, Tim. “Archipelagic security: future of the Seychelles Coast Guard”. *Australian Naval Institute*. May 6, 2016. Accessed September 04, 2017: <http://bit.ly/2yliBjW>

252 Food and Agriculture Organisation of the United Nations. “Fishery Country Profile – Mauritius”. January 2006. Accessed September 27, 2017: <http://www.fao.org/fi/oldsite/FCP/en/MUS/profile.htm>

253 Government of Mauritius. *The Seafood Hub*. Accessed September 4, 2017: <http://oceaneeconomy.govmu.org/English/Departments/Seafood%20Hub/Documents/The%20Seafood%20Hub.pdf>

254 Since 2009, Defence claims that the Royal Australian Navy has thwarted six acts of piracy in support of Combined Task Force 150.

255 Oceans Beyond Piracy. “The State of Maritime Policy 2016 – Executive Summary”. 2016. Accessed September 4, 2017: <http://oceansbeyondpiracy.org/reports/sop>

Combined Maritime Forces, a task group set up to patrol the Western Indian Ocean region, claims to have seized over 9,300kg of high-purity heroin on dhows.²⁵⁶ It is noteworthy that the Royal Australian Navy has played a key role in some of these interdictions. For example, since 2014, Australian warships have seized 24 shipments of heroin weighing around 6,000kg, and seven shipments of hashish weighing about 18,200kg.²⁵⁷

Countries across the Indian Ocean littoral have sought to bolster their maritime interdiction capabilities through the modernisation and expansion of their navies and the establishment of coast guards. There are now at least 24 coast guard forces in the Indian Ocean region.²⁵⁸ From 2010 -2013 alone, four new coast guard forces were raised among Indian Ocean states, namely the Comoros, Djibouti, Kenya and Sri Lanka.

The rapid growth of navies and nascent coast guards in the Indian Ocean region offers a unique opportunity for Australia to maximise existing diplomatic, defence, and aid programs. By enhancing the maritime enforcement capabilities of Indian Ocean states, much like with the Pacific Patrol Boat Program, Australia would be providing an injection of capability to the Indian Ocean region. This would have the impact of bolstering the region's overall security and stability, while promoting Australian strategic interests.

Former Defence and Foreign Minister, Stephen Smith, concurs:

The global strategic and economic centre of gravity is shifting to the Indo-Pacific, where Australia and Indonesia lie at its fulcrum. The rise of Indian Ocean powers India and Indonesia, partners with Australia in the Indian Ocean Rim Association and the Indian Ocean Naval Symposium, mean Australia must continue to align its force posture accordingly. The littoral states of the Indian Ocean rim are disparate and diverse in their stages of economic development and maritime prowess. With an increased strategic weight and focus placed on the Indo-Pacific, traditional and non-traditional security challenges facing Australia and its regional partners in the Indian Ocean will only increase. Australia as one of the advanced maritime and naval nations, should support the maritime maturity of less well-developed neighbours in the Indian Ocean rim. Australia's Pacific Patrol Boat Program has had its challenges, but over time it has seen dividends paid to Australia and its regional partners in the Pacific. Given the lessons learnt from the Pacific, and the shift of geo strategic weight to the Indian Ocean, a carefully targeted Indian Ocean Patrol Boat Program is well worth considering.²⁵⁹

256 United Nations Office on Drugs and Crime. "Indian Ocean: 'Colombo Declaration' adopted to coordinate anti- drugs effort". November 4, 2016. Accessed September 4, 2017: <http://bit.ly/2z5Hb5T>

257 Email correspondence. Defence Media, September 26, 2017.

258 These include six east African, eight Middle Eastern, five South Asian and five Southeast Asian states.

259 Personal communication. Stephen Smith, Former Defence Minister, 7 October 2017.

Indeed, the establishment of this program in the Indian Ocean region would further align with the conclusions of the 2017 Commonwealth Government *Inquiry into the Strategic Importance of the Indian Ocean Territories*, which affirmed:

A secure, stable and interconnected Indian Ocean, and broader Indo-Pacific region, is crucial for Australia's national security and prosperity. The countries of the Indian Ocean rim are Australia's neighbours, and many are also important trade and security partners. Our economy relies on the free and secure passage of maritime trade through the Indian Ocean.²⁶⁰

Given that a large portion of naval and maritime shipbuilding in Australia is, and has traditionally been, WA-based, the establishment of an Indian Ocean Patrol Boat Program, has the added benefit of stimulating the local naval and maritime sector by generating more work and creating more employment opportunities.

5.3 A Case for Expanding Army in the West

Thirdly, there is a strong case for expanding the Australian Regular Army in WA. For decades, a significant shortcoming of successive Commonwealth *Defence White Papers*, with exception to the *1987 Defence White Paper*, has been either the minimal, or the absence of, rigorous public debate on augmenting Defence force posture in the West. This has been particularly in relation to Army.

Although the 2016 Defence White Paper identified much-needed and long-overdue reinvigoration of investment in Defence infrastructure in WA, the force structure of the Army in the State still remains unchanged. With the rising importance of the Indian Ocean region, and the growing sensitivity regarding Australia's northern and western approaches, there is an unprecedented strategic case to enhance the profile of Army on the western recesses of the Australian continent.

The debate around the role of the Army in WA is not a new one. The *1987 Defence White Paper* generated attention around the near absence of land forces permanently deployed in Australia's north, resulting in the Army Presence in the North (APIN) project, and the relocation of the 1st Brigade from Sydney to Darwin during 1995-1998. Elements of 1st Brigade were again relocated from Darwin to Adelaide, and this resulted from the de-linking of the 5th/7th Battalion, Royal Australian Regiment (5/7RAR), to re-establish the 7th Battalion, RAR (7RAR) in Adelaide.²⁶¹ Again, in November 2014, the 2nd Cavalry Regiment was moved from the 1st Brigade to the 3rd Brigade and, in doing so, was transferred from Darwin to Townsville.²⁶² The 1st Armoured Regiment also has to be relocated from Darwin to Adelaide along with some supporting command and combat services support elements of the 1st Brigade.

Although not referenced in the *1987 Defence White Paper*, there was, at the time, an internal discussion within Army, which considered relocating the SASR to the East Coast, and replacing it with a regular Army battalion. Strong opposition from the SASR led to this proposal being shelved.²⁶³ Since then,

260 Joint Standing Committee on the National Capital and External Territories. *Inquiry into the Strategic Importance of the Indian Ocean Territories*. Australian Government Department of Foreign Affairs and Trade. January 2017. Accessed September 4, 2017: <http://bit.ly/2htix7y>

261 Wheatley, Kim. "7RAR Battalion coming to South Australia in boost for defence industry". The Adelaide Advertiser. February 7, 2010. Accessed September 5, 2017: <http://bit.ly/2zmooG6>

262 Department of Defence. "2nd Cavalry Regiment Arrives in Townsville". Media Release. 28 November 2014. Accessed October 8, 2017: <https://news.defence.gov.au/media/media-releases/2nd-cavalry-regiment-arrives-townsville>

263 Personal communication. Former Defence Minister Kim Beazley, September 1, 2017.

and to date, the public debate on Defence force posture in WA has been overwhelmingly fixated on the North West. A case in point is demonstrated by former Liberal Party Senator for Western Australia, Alan Eggleston, who on May 28 2012, told the Senate Defence Committee Estimates:

It is reprehensible that the ADF is instead wedded to the North Queensland comfort zone where the vulnerability is minor compared to Western Australia's coast, with more than \$320 billion in minerals and oil and gas invested in the region. I have been told that American investors in Western Australia's oil and gas industry have already expressed concern that there is very little military presence or protection for these big investments. Current Defence operations including patrol boats operating 90 days a year outside the region and P3's [sic] flying over the airspace is not a high enough level of protection for this enormous investment industry. The ADF needs to stop 'considering' how they might increase their presence in the North West and instead begin to implement the necessary infrastructure to make it happen.²⁶⁴

Since these comments were made, Defence implemented additional measures to strengthen its profile in the North West through a series of exercise scenarios. They include EXERCISES BLUE RAPTOR, IRON MOON, DAY SHARK and more significantly NORTHERN SHIELD, the latter designated a

major annual exercise.²⁶⁵ In addition, and apart from occasional senior Defence delegations, the Australian Defence College, up until 2016, sent course members from the Australian Command and Staff College course for familiarisation tours.

Yet the increased Defence profile in the North West only through military exercises seems to have failed to placate local opinion, as demonstrated by the Mayor of the City of Karratha, Peter Long, who in 2014 stated: "There are 8000 soldiers in Townsville guarding the Great Barrier Reef, and you have 50 personnel guarding a trillion dollars' worth of investment throughout the North West."²⁶⁶ In part, this is true, as the two reserve RFSUs, the Pilbara Regiment²⁶⁷ and the Kimberley Squadron of NORFORCE, have only a partial Regular Army element seconded to them, and these units constitute the only Army presence in the North West.²⁶⁸

“There are 8,000 soldiers in Townsville guarding the Great Barrier Reef, and you have 50 personnel guarding a trillion dollars' worth of investment throughout the North West.”



264 Eggleston, Alan. "Opinion: Alan Eggleston on NW Defence". *The Kimberley Coast*. May 29, 2012. Accessed September 5, 2017: <http://www.kimberleypage.com.au/2012/02/opinion-alan-eggleston-on-north-west-defence/>

265 DeSilva-Ranasinghe, Serge. "Western Australia: The ADF's Significant Security Focus". *Australian Security Magazine*. June - July 2014.

266 City of Karratha. "2015 Defence White Paper Submission". 2015. Accessed September 5, 2017: <http://bit.ly/2gT9HiH> p. 9.

267 The Pilbara Regiment has a Regular Army cadre of 55 personnel that forms the unit's backbone.

268 It is noteworthy that during World War II there were more than 600 Army personnel deployed across the North West, mostly on reconnaissance and garrison duties.

Figure 09

Western Australia Resource Projects



The aforementioned examples suggest that irrespective of strategic necessity, there are practical limitations to basing substantial land forces in remote regions of Australia. Defence has recognised that it is more practical to collocate Army units near major population centres with supporting infrastructure and services.

In addition, workforce planning factors challenge the sustainability of remote postings. Most Defence personnel are recruited from major cities, where their family and support networks reside, job and education opportunities exist for family members, and a full array of government and community services are available. Yet challenges persist even in a large regional capital city the size of Darwin, with a population of over 142,000 replete with quality modern health and educational facilities. If basing troops in Darwin

may remain a matter of some contention, the complexity of permanently basing large troop concentrations in the North West of Australia is likely to be untenable under current circumstances. Similarly, regional centres such as Karratha, Port Hedland and Broome are far located far from Perth and Darwin. There is no railway line that connects Perth to the North West, unlike in the case of Adelaide and Darwin.

However, given the lack of a significant Army presence on the western half of the Australian continent, it is in Australia's national interest that WA be party to any future dialogue that involves the raising or relocation of Army units. As the importance of the Indian Ocean and Asia-Pacific regions continue to rise, so will the need to rethink existing force posture. This was previously affirmed by the 2012 *Australian Defence Force Posture Review*,

which confirmed:

While there is much that is commendable in the ADF's current force posture, there are also some significant weaknesses and risks that will become more pressing over coming years in meeting Force 2030 requirements. These mostly relate to the capacity [emphasis in the original] of the ADF bases, facilities and training areas to support current and future capabilities, particularly in Australia's North and West, and our ability to sustain high tempo operations in Northern Australia and our approaches, the immediate neighbourhood and the wider Asia-Pacific region.²⁶⁹

Taking into account the deliberations of the *Force Posture Review*, in 2015 AIDN-WA was the first organisation in the State to make public the case to field an expanded Army presence in a submission to the *2016 Defence White Paper*. In relation to Army, AIDN-WA in part advocated:

It does not make strategic sense to have all of Australia's multirole combat brigades stationed on the East Coast and Darwin, whilst a third of the country remains without a serious regular army presence. As Australia's recent commitment of combat ground forces to the Afghanistan and Iraq campaigns, and the peacekeeping operations in Sudan and Somalia, have demonstrated, the Indian Ocean region remains a likely area for the deployment of ground troops. Having a multirole brigade stationed in the West would offer considerable time advantages for amphibious expeditionary operations, if LHDs were to utilize HMAS Stirling, and could result in the formation of a quick reaction force that could utilize C-130s operating from RAAF Base Pearce in the event of a sudden crisis.²⁷⁰

Indeed, while the lack of appetite in Defence to permanently base large troop concentrations in the remote North West is understandable, a substantive Regular Army presence in or near Perth merits serious consideration. Clearly, the same logic that applied to the Navy's force posture decisions in the 1980s – that the concentration of WA's population, industry and infrastructure is located in Perth, thus the implementation of the Two Ocean Navy was centred at HMAS *Stirling* - has relevance to Army today.

“While the lack of appetite in Defence to permanently base large troop concentrations in the remote North West is understandable, a substantive Regular Army presence in or near Perth merits serious consideration.”



269 Allan Hawke and Ric Smith. *Australian Defence Force Posture Review*. Australian Government. March 30, 2012. Accessed September 5, 2017: <http://www.defence.gov.au/Publications/Reviews/ADFPosture/Docs/Report.pdf> p.28.

270 Australian Industry and Defence Network WA. "AIDN WA Submission to the 2015 Defence White Paper". 2015. Accessed September 05, 2017: <http://www.aidn-wa.org.au/Advocacy> p.5.

Figure 10

Strategic Geography of the Indian Ocean

April 1942



A substantial Army presence in WA is not without historical precedent as demonstrated during World War II, when a major Japanese threat to mainland Australia materialised. At the onset of the war, the Army in the West came under the purview of Western Command (formerly the 5th Military District), with responsibility over all troops deployed throughout WA, except for the Kimberley region. By late 1942, the rapid build-up of the Army in WA was illustrated by 3rd Australian Corps deploying two infantry divisions between Perth and Geraldton.²⁷¹ Extensive corps and reinforcement training was conducted at

Northam, involving both senior and junior officer courses. Specialist and higher training was undertaken at Harvey, 139km south of Perth, and included intelligence, mortars, anti-aircraft and anti-tank weaponry courses.²⁷²

In October 1942, Army conducted one of the largest military exercises in Australian military history to date. EXERCISE ROBBER involved the 4th and 2nd Divisions and an estimated 16,000 troops.²⁷³ Furthermore, by December 1942, out of a total of 23 brigades deployed throughout Australia at the time, six brigades were based near Perth, and amounted to

271 In late 1942, a standard full strength Australian Army infantry division comprised around 15,000 troops or 11 battalions (nine infantry battalions, one machine gun battalion and one pioneer battalion).

272 Personal communication. Military historian Graham McKenzie-Smith, September 3, 2017.

273 Personal communication. Graham McKenzie-Smith, September 3, 2017.

26% of Army's combat formations in Australia at that time. In fact, WA ranked second in overall concentration of combat formations in comparison to other states. Ranked first was New South Wales with seven brigades or 30%, Queensland ranked third with five brigades or 22%, and Northern Territory ranked only fourth with three brigades or 13%.²⁷⁴

Between October 1942 and February 1943, the 1st Armoured Division, which was equipped with around 200 tanks, was transferred to WA.²⁷⁵ It was one of only two fully formed armoured divisions in Australia during the war. Heavily invested in defeating the Japanese in the Southeast Asian archipelago, Army's operational doctrine emphasised training in amphibious and jungle warfare. As such, a jungle warfare training centre was established at Wellington Mill, near Collie, about 200km south of Perth.²⁷⁶ This was one of only two such facilities in Australia during the war, the other being located at Canungra, Queensland. The training centre at Wellington Mill has the capacity to train a complete battalion. Similarly, in 1943, the Army established two amphibious warfare training centres, one at Point Walter, Fremantle, and the other at Geraldton 414km north of Perth, both of which trained an estimated 20-25,000 troops throughout the war. Cumulatively, it is estimated some 50,000 troops were stationed in WA during World War II.²⁷⁷

During World War II the strategic rationale behind such an unprecedented concentration of troop strength near Perth was fundamentally due to WA's strategic importance to Australia, proximity to operational theatres, and perceived vulnerability to Axis naval interdiction. It

is likely that Defence planners at the time deemed leaving WA without a substantial land force too significant a strategic risk. As Australia's north-western flank, WA was key to maintaining the strategically vital communications and logistical link with the British Empire via the Indian Ocean.²⁷⁸

WA also hosted a massive submarine base, and the State served generally as a base and springboard for strikes, including special forces operations. These included notable Z Special Force raids OPERATION JAYWICK and OPERATION RIMAU. Forward airfields throughout the State provided a layer of air defence and were critical for both the Royal Australian Air Force, and US Army Air Force, to project to Australia's northern and western approaches, and into the Southeast Asian archipelago.

In the contemporary context, as Australia's fourth-largest city, Perth sustains a population of over two million, and has all the modern facilities and lifestyle comforts of the other major capital cities. In addition, and much like in World War II, there is an increasingly valid strategic, military and socio-economic logic to permanently base additional Regular Army forces in this part of Australia. There is ample availability of land to establish additional nearby bases and training areas. Importantly, both Perth and the immediate zone surrounding the city are in close proximity to overseas deployment zones in both the Indian Ocean and Asia-Pacific regions. Defence industry in Perth is also mature and substantial enough to provide adequate sustainment support.

Perth is located on an established national

274 McKenzie-Smith, G. *Australia's Forgotten Army, Volume 1: The Ebb and Flow of the Australian Army in Western Australia 1941 to 1945*, Grimwade Publications, Canberra 1994, pp. 88-89.

275 McKenzie-Smith, G. *Defending Fremantle, Albany and Bunbury 1939 to 1945*, Grimwade Publications, Mt Pleasant, 2009, p. 27.

276 McKenzie-Smith, G. *Sappers in the West: Army Engineers in Western Australia*, RAE Association of WA, Balga, 2015, p. 122.

277 Personal communication. Graham McKenzie-Smith, September 3, 2017.

278 "Double Sunrise Flights". *Pathfinder*. Issue 156, May 2011. Accessed October 8, 2017: <http://bit.ly/2A5fji4>

railway system that links to East Coast capital cities. This provides Army with the capability to transport heavy equipment and bulk supplies from one side of the continent to the other if required. Furthermore, the concentration of a substantial troop presence near Perth would enable the ADF to strengthen its profile in the North West, enabling regular troop rotations on exercises throughout the year, and thereby providing another layer of security to the region.

Should the general region surrounding metropolitan Perth be selected as the location for an Army formation to be based, concerns about retaining personnel would be significantly diminished. The problem of retention that the Army faces in WA is that the only Regular Army unit is the SASR, and there remains limited opportunities for respite or other postings among the three Army Reserve units: the 13th Brigade, Pilbara Regiment and Kimberley Squadron of NORFORCE.

Since the 1970s the Regular Army's presence in WA has been steadily reduced in size for a variety of reasons with the disbandment of the 22nd Construction Squadron in 1990, and the 5th Military District in 1992.²⁷⁹ Indeed, as of December 2017 onwards, as announced at the 13th Brigade Association Stakeholders Night earlier the year, the 13th Brigade will be, for at least one year, or possibly more, commanded by an Adelaide-based Army Reserve Brigadier who will be visiting WA on a fly-in fly-out basis.

As it stands, the small Army presence in WA, means that unless assigned to Special Operations Command, Regular Army personnel recruited from WA have a limited opportunity to spend part of their career in, or near, their home and family support networks. Such

retention issues are not unique to Defence, and are acknowledged by other industries, and even professional sporting teams.

Hence, any expansion of the Regular Army presence in WA would also expand geographic posting options for Defence personnel, improving retention and reducing workforce instability. WA has also been a fertile recruitment ground for the ADF, and the presence of an Army formation near Perth could in large measure be sustained through local recruits. Supporting this proposition is the former Defence Force Recruiting, WA Area Manager, Phil Sumner (2006-2015), who confirmed: "The State of Western Australia is a fertile recruiting ground and has, over the last 10 years, maintained one of the largest application 'pipelines' nationally. Over this period, the recruitment of full-time Army recruits has featured regularly as a high-end achievement. These attributes combined with a progressive increase in enlistments indicate that the availability of recruits locally would be enhanced significantly by the establishment of a regular Army brigade in Western Australia."²⁸⁰

The relocation of an Army brigade would also substantially benefit the existing arrangement and circumstances of the 13th Brigade, which is constrained by the absence of some facilities deemed standard to most Army units based throughout Australia. The Commander of 13th Brigade, Brigadier David Thompson, explained:

279 The 22nd Construction Squadron was based at Irwin Barracks, Karrakatta, and served as the well-drilling capability for Army, and as a general purpose construction squadron. This unit was responsible for building among other facilities Campbell Barracks, Bindoon Training Area, and the Irwin Barracks Officers Mess. It is noteworthy that the recent commencement of the redevelopment of Campbell Barracks is until recently the only major Army infrastructure project in WA since the mid-1970s, when the Barracks was first built. See McKenzie-Smith, Graham. *Sappers in the West*. 2015, see Sections 8, 9, 10 and 11 for further reference.

280 Personal communication with Phil Sumner, 6 October 2017.

Most army reserve brigades are near or collocated with regular army brigades. This means that there is a greater possibility of a transition of operationally experienced persons from full-time to part-time service. However, WA must grow and train its army reservists from ‘cradle to grave’ with few transfers from the full-time army. Also, most army reserve brigades can use the synergies of being co-located with regular army units and establishments to leverage off regular army personnel and equipment for training as experienced on the eastern seaboard.²⁸¹

Currently, the lack of an Army presence in WA also means that there are limited resources available within the State to draw upon in times of emergency, where response times are a major consideration, particularly in relation to humanitarian assistance and disaster relief, and aid to civil power contingencies.²⁸² While there are six categories of Defence Aid to the Civil Community (DACC), two should be given consideration where WA is concerned. DACC Category 1 relates to local emergency situations when immediate action is necessary to save life. DACC Category 2 relates to extensive or continuing disasters when State resources to perform roles such as search and rescue, transport, evacuation, and communications are inadequate.²⁸³

In each case, following any such request, Defence response is time critical. However, in WA’s case, the lack of an Army presence, compounded by the tyranny of distance from other resources, means that substantive Defence assistance is neither timely, nor comparable with that available to the eastern states, or even the Northern Territory.

In 2011, PLAN BEERSHEBA reorganised the bulk of Army’s conventional fighting forces around three multirole combat brigades. The capability contained within each of these brigades was to be collocated to ensure that opportunities for joint training were enhanced and battle-grouping could be as seamless as possible.²⁸⁴

However, irrespective of this policy collocation has not always been possible as in the case of 1st Brigade, which has capability distributed between Darwin and Adelaide. Should Army consider relocating a brigade to WA the most obvious formation to consider transferring is the 7th Brigade at Enoggera Barracks, Brisbane. The Barracks at Enoggera is considered too small to host a multirole combat brigade, lacks the space to expand due to urban encroachment, and is inconveniently situated to access training areas. In the event Army seriously considers relocating the 7th Brigade, it is possible that in the interests of force structure coherence and efficiency, this could result in the relocation of the entire brigade.²⁸⁵ While any attempt to transfer forces to WA would likely take up to a decade in duration to implement, the relocation to metropolitan Perth would be the most suitable location

281 Personal communication. Brigadier David Thompson, Commanding Officer, 13th Brigade, 2017.

282 For example, the Department of Fire and Emergency Services recently commented that the army engineer unit in WA does not train in bridging, and that no army bridging stores are kept in WA, so the army cannot assist if a replacement bridge is required in the instance of an emergency like a catastrophic bushfire or flood.

283 Department of Defence. *Defence Instructions (General)*. March 16, 2004. Accessed September 5, 2017: <http://bit.ly/2gU0x5j> p. 3.

284 The Army’s three multirole brigades are deployed as follows: 1st Brigade in Darwin and Adelaide, 3rd Brigade in Townsville and the 7th Brigade in Brisbane. Battlegroups are formed through the clustering of capability from across a brigade, namely infantry, armour, combat support and combat services support to create a fighting unit tailored to suit a specific threat or situation usually for overseas deployments.

285 The last time Army transferred an entire brigade was between 1992-1999, when the 1st Brigade moved to Darwin in a phased process that took nearly a decade to complete.

to base an Army brigade in WA. An ideal site could be Bullsbrook/Muchea, a semi-rural area where Defence already owns land, and is adjacent to the expanding north-eastern suburbs of Perth.

The advantage of situating a base at Bullsbrook/Muchea would be collocation with nearby RAAF *Pearce*, establishing a super-base along the lines of *Edinburgh*, South Australia, and *Amberley*, Queensland. There are also options to establish fit-for-purpose bases to the north and south of Perth. The Bullsbrook/Muchea area is also within close proximity to other key Defence facilities such as Joint Logistics Unit-West (JLU-West), Campbell Barracks, HMAS *Stirling* and training areas at Bindoon and Lancelin. Furthermore, should the Western Trade Coast initiative to build a new industrial port in Kwinana be developed,²⁸⁶ the provision of nearby large and modern port facilities, in addition to the existing port at Fremantle, would enhance Army logistical and deployment options.

As well as compelling reasons of strategic balance and force posture, an Army presence in WA would also make a substantial nation-building contribution to the State. Most recently in Adelaide, the relocation of 7RAR from Darwin, annually injects, via salaries, more than \$100 million into the economy of South Australia.²⁸⁷ In addition, the capital expenditure on new barracks, infrastructure and training facilities has provided a major economic boost to the State's economy. If, over time, an Army brigade and its supporting elements (potentially in the order of 3,000 personnel and their families) were relocated to WA, similar nation-building outcomes would eventuate.

The annual recurrent spending in salaries, maintenance and sustainment of a force this size would constitute a substantial economic stimulus, and annually could be worth over

\$500 million to the WA economy. Should this brigade-sized force be located in a new defence super-base centred around RAAF *Pearce*, it would also allow extensive redevelopment of existing infrastructure, and lead to the provision of new infrastructure, both military and civilian, including public works, housing, schools and other amenities.

The permanent presence of an Army formation near Perth would also require a large manoeuvre training range to be created to support combined arms exercises in nearby regional WA. Due to the sheer size of WA and the vast expanses of available Crown land, a training range similar in size to that of the 900,000ha Bradshaw Field Training Area in the Northern Territory, the 457,300ha Shoalwater Bay Training Area in Queensland, the 209,000ha Cultana Training Area in South Australia, and the 100,000ha Mount Bundy Training Area (also in the Northern Territory), is not infeasible. Importantly, the benefits of basing an Army formation near Perth also provides the opportunity to train all year round, unimpeded by a rainy season, unlike in the case at 500,000ha Yampi Sound Training Area in the Kimberley. As Defence's largest training area in WA, and second-largest land training area in the country, Yampi Sound Training Area is a remote and inaccessible location, and as a result is seldom used.

Creating another training area in the State outside of the North West of WA, offers Defence an array of new opportunities for consideration. Take for instance the comments made by the Director Estate and Facilities Services in 2015: "Defence would desperately love to have an all seasons training range in WA. There have been some studies done in, and around, Yampi Sound, but the large tidal changes, terrain, weather conditions and the nearby national marine park has put a lot of constraints on its use and ease of access."²⁸⁸

286 Western Trade Coast Australia. "About the Western Trade Coast". 2017. Accessed October 8, 2017: <http://www.westerntradecoast.wa.gov.au/>

287 Wheatley, Kim. "7RAR Battalion coming to South Australia in boost for defence industry". *The Adelaide Advertiser*. February 7, 2010. Accessed October 16, 2017: <http://bit.ly/2zmooG6>

288 Interview. Gavin Nicholls Director Estate and Facilities Services, Estate Services-Central and West, Estate and Infrastructure Group, June 10, 2015.

“The enhanced profile and capabilities of Army in WA would provide more opportunities to train with armies of Indian Ocean littoral states, particularly with France, India and Singapore, which would enhance interoperability, strengthen regional security, and further consolidate Australian strategic interests in the Indian Ocean and Asia Pacific regions.”



Photo courtesy of Serge DeSilva-Ranasinghe

From a strategic and alliance perspective, an increase in Army's profile in WA would also provide opportunities for enhanced cooperation with Australia's allies and strategic partners, particularly the US. An increased Army presence in the West, and the creation of new facilities and training areas would offer US forces an opportunity to undertake largescale conventional military exercises in WA, which can be capitalised upon when its army and marine corps contingents transit to, and from, the Middle East and the Asia-Pacific.

Similarly, noting the global shortage of large manoeuvre training areas, the enhanced profile and capabilities of Army in WA would provide more opportunities to train with armies of Indian Ocean littoral states, particularly with France, India and Singapore, which would enhance interoperability, strengthen regional security, and further consolidate Australian strategic interests in the Indian Ocean and Asia Pacific regions.

The concept of expanding Army's profile in WA has received the strong endorsement of respected strategic and defence commentators. Former Defence Minister Kim Beazley, recently stated:

There is an imbalance in service assets in WA. The Navy takes advantage of the geographic proximity of WA to our main area of interest in South East Asia and growing interest in the Indian Ocean region. The Army achieves that proximity in Darwin but it would be enhanced by a similar deployment in WA. That is an idea well worth considering. This is particularly the case when the training opportunities for 7th Brigade at its current location are considered. WA offers space and variety conveniently. Proximity is important considering that our most exposed assets in the mining and energy sectors reside in WA. In the increasingly threatening environment regionally and globally they constitute a major pressure point in potential against us. Signalling is a strong part of deterrence and a brigade in WA would be a major signal of Australian determination.²⁸⁹

Former Chief of Army, Lieutenant General Peter Leahy (Retd), concurs:

WA's vast and sparsely populated land area is an asset to the Army's future interests. Preparations should be considered for the long-term. Likely activities should include the development of planning options for more Army elements in the decade ahead, such as the eventual relocation of either a battalion, or even a brigade. The Commonwealth should look at reserving land for maneuver training, and also multi-purpose air, missile and electronic ranges. Given the State's size, value to the Australian economy, future growth prospects, and the rapidly developing geo-strategic importance of the Indian Ocean and Asia Pacific regions, the public debate on WA's contribution to the defence and security of Australia is increasingly necessary.²⁹⁰

289 Personal communication. Former Defence Minister Kim Beazley, September 10, 2017.

290 Email correspondence. Former Chief of Army Lieutenant General Peter Leahy, July 9, 2017.

In the light of the evidence presented it is apparent that any debate on future Army posture must include WA. The strategic importance of the State, and the array of advantages it presents to Army, indicates that further and serious investigations should be conducted by Defence. Possessing the capability to deploy from both the west, and the east, of the continent, enhances the defence and security of Australia, and provides a greater deterrence to the growing likelihood of would-be regional adversaries.

It is ultimately a question of political will at the Commonwealth level to make this a reality, much like what was previously demonstrated around the time of the *1987 Defence White Paper*. Such an important and long-term proposition should form a key component of the next Defence White Paper.



Photo courtesy of Department of Defence

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Conclusion

The wealth in WA does not purely come from its abundant resources. The State is perfectly positioned to maximise itself as a showcase for Australia's defence industry, a host to an expanded Defence presence, and Australia as a more serious and strategic Indian Ocean power. This report demonstrates that there has never been a more fortuitous, or important, time to grow the defence sector in WA.

This report has detailed a number of initiatives that could create this reality. Such initiatives, detailed in 25 recommendations, are directed at the Commonwealth, State, and local governments, and defence industry. The opportunities for synergies and expansion across sectors are clearly identified.

For the Commonwealth, and in keeping with the *2016 Defence White Paper, 2016 Defence Industry Policy Statement, 2016 Integrated Investment Program*, and recent pronouncements by Commonwealth Ministers, this can be developed through greater engagement and a demonstrated understanding of the requirements of other Indian Ocean countries – principally through a gifted patrol boat program or export of other military capabilities.

For all stakeholders, there is a bounty of opportunities in the existing resources, space, industry and tertiary sectors where synergies for future cooperation undoubtedly exist. The 25 recommendations that emerged from the report's analysis are tangible and implementable.

The greatest benefit will come from a carefully staged, and planned, implementation of these recommendations. Some require considerable investment and timeframes. These include the expansion of Army in WA, creating a Centre for Undersea Excellence and an expansion of the Patrol Boat Program.

Others are implementable almost immediately – such as cadetships and pathways for Indigenous personnel and appointing Indigenous ADF Ambassadors. Ensuring reliable telecommunications and web-based communications infrastructure is vital, and will further enhance the ability of the State's tertiary sector to continue to attract funding and maintain the edge on research and development, particularly in the cyber domain.

Being the hub for developing and testing autonomous systems, and host to a national space agency would bring the State further international standing. Such developments would aid in greater national understanding of the opportunities in WA.

Sister city arrangements between local governments and other provinces or cities that have renowned defence industry capabilities drives and nurtures international linkages and industry development. Finally, a 'Team WA' approach for defence industry can champion and lead the future of the State's defence sector.

In summary, this report will stand as a point of reference and a pathway to a dynamic defence sector in WA in the future.

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Appendices

Appendix A:
R&D Expertise of
WA Universities

Appendix B:
Defence C4ISR
Investment
Programs

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Appendix A: R&D Expertise of WA Universities

Murdoch University

- 1. Murdoch University Energy Research and Innovation Group (MUERI)**

MUERI is a cross-disciplinary group and has strong collaboration with The Algae R&D Centre at Murdoch. This collaboration includes work on computational modeling of the algal cultivation systems, process design, process control and techno-economic assessment of a range of systems or applications.
- 2. Information Systems Research Group**

The Information Systems Research Group includes several academic staff members and many postgraduate research students. A broad range of research areas within information systems are explored. These include: information security behavior, e-learning and information technology education, social media, open source software collaboration, HCI.
- 3. Networking and Security Research Group**

The Networking and Security Research group contains several academic staff members and numerous postgraduate research students. Both applied and theoretical topics are explored. The pure networking topics include: routing protocols, wireless networks, TCP congestion control and Active Queue Management (AQM), IPv6 and Mobility.
- 4. Centre for Combinatorics on Words and Applications**

The Centre for Combinatorics on Words and Applications (CCWA) was established at Murdoch University in late 2014 to provide a forum for an international exchange of ideas, and the development of new theorems and algorithms related to combinatorics on words.
- 5. Intelligent Virtual Environment & Simulation Research group**

The Intelligent Virtual Environment and Simulation or IVES is a research group at the School of Engineering and Information Technology at Murdoch University to identify and nurture promising research areas in the disciplines of intelligent systems and interactive virtual environment. IVES focuses on intelligent data analytics, data science, data mining, pattern recognition, 3D virtual environments (including Virtual and Augmented Realities), simulation, human computer interactions and interfaces, learning analytics, and computational intelligence techniques.
- 6. Marine Science Institution**

The Western Australian Marine Science Institution (WAMSI) is a leading Australian marine research organization. Its structure is like no other because it is a collaboration of State, Federal, industry and academic entities cooperating to create benchmark research and independent, quality scientific information. It carries out research into climate change, biodiversity, the iconic Ningaloo Marine Park, sustainable fisheries, biotechnology and oceanography, and has overseen the development of a marine bioresources library that will store thousands of marine samples collected by researchers.
- 7. The Centre for Comparative Genomics**

The Centre for Comparative Genomics (CCG), a Western Australian State Government Centre of Excellence, undertakes unique biomedical and agricultural research and development. The CCG promotes collaborative understanding within and across fields of study. The Centre has four research themes: Personalised Medicine, Animal Health, Food Security and High Performance Computing.
- 8. School of Engineering and Information Technology Minerology and Geochemistry Group**

The group focuses its research on fluid-mineral interactions, in particular on crystallisation of ore minerals, mineral replacement reactions, metal extraction and recovery, formation of metallic nanoparticles in minerals and synthetic compounds, amorphisation, dissolution and precipitation process, liberation and sequestration of radioactive elements, isotopic fingerprinting, carbonation reactions and storage of CO in minerals. The group possesses expertise in a wide range of cutting-edge analytical and experimental techniques for mineralogical, chemical and microscopic characterisation of minerals, rocks and synthetic phases, such as in-situ X-ray diffraction, (MC-) ICP- MS, IRMS, EMPA, SEM, TEM and nano-SIMS with distinguished records of publications, innovations and funding from external sources.

9. School of Engineering and Information Technology Surface Physics and Nanotechnology Group

Research in this area is concentrated on the design, fabrication and quantum mechanical computational modelling of functional nanostructured and nanosized materials for use in environmental, renewable energy, mechanical and medical applications. The research focus is on the physico-chemical properties of the materials which include: super hardness; optical selectivity; corrosion resistance; thermal mechanical stability and biological compatibility.

10. School of Psychology and Exercise Science Mind and Body Laboratories

The School offers a purpose built set of Exercise Science Laboratories that was opened in 2011. The facilities are used extensively for both research and teaching. Included in the facility is a dedicated Exercise Physiology Laboratory, a Rehabilitation, Strength and Conditioning Laboratory and a Performance Laboratory used for biomechanics and motor control research and teaching. All three laboratories have been fitted with the latest equipment to ensure graduates are highly trained and will gain valuable hands-on experience using the latest equipment.

Curtin University

1. Curtin Institute of Radio Astronomy

Curtin Institute of Radio Astronomy (CIRA) covers a wide range of projects in the area of radio astronomy, including aspects of next generation telescopes such as the MWA and ASKAP as well as the Square Kilometer Array at the Murchison Radioastronomy Observatory. It maintains a 20 node (dual-processor, quad-core machines = 160 core) parallel computer dedicated to data processing, with approximately 100 TB of data storage space.

2. Murchison Widefield Array

The Murchison Widefield Array (MWA) is a low-frequency radio telescope operating between 80 and 300 MHz. It is located at the Murchison Radio-astronomy Observatory (MRO) in Western Australia, the planned site of the future Square Kilometer Array (SKA) lowband telescope, and is one of three telescopes designated as a Precursor for the SKA.

3. The International Centre for Radio Astronomy Research

Since our launch, ICRAR has played an integral role in the development of the SKA project and has grown into an internationally renowned, multi-disciplinary research centre for science, engineering and data intensive astronomy.

4. Pawsey Supercomputing Centre

The Pawsey Supercomputing Centre operates multiple supercomputers, data-intensive machines and storage systems that use the most advanced technologies available.

5. Curtin Institute for Computation

The Curtin Institute for Computation (CIC) was established to meet this increasing demand for computational modelling, data analytics, and visualization. The CIC initiates and fosters collaborative, interdisciplinary research and education programs with researchers.

6. CRC for Spatial Science 2 (CRCSI2)

We are a collaborative research centre. We push the frontiers of spatial science in partnership with university researchers, government agencies, the private sector and international organizations.

7. Innovation Central Perth (Collaboration with Cisco)

A unique collaboration of industry leaders has joined forces to drive digital innovation. Our mission is to champion a new generation of innovation and help create the digital success stories of tomorrow. Sharing a common goal of driving innovation in Australia, Cisco has come together with partners Curtin University and Woodside Energy.

- 8. Desert Fireball Network** The DFN is a research project aiming to uncover the mysteries surrounding the formation of the solar system through the study of meteorites, fireballs and their pre-Earth orbits. The project is based at Curtin University in Perth, Western Australia and together with NASA, the DFN is expanding to a Global Fireball Observatory. Using an autonomous network of observatories, built from scratch with custom and consumer parts, these cameras track and triangulate fireballs, the fall positions of the meteorites and their pre-earth orbits from multiple viewpoints. Currently the DFN observatories cover a third of Australian skies, taking pictures all night, every night, and increasingly of the skies from other countries around the world.
- 9. Centre for Smart Grid and Sustainable Power Systems** The Centre for Smart Grid and Sustainable Power Systems focuses on fundamental and applied research to develop advanced knowledge in electrical power engineering.
- 10. WA Energy Research Alliance** WAERA delivers direct access to a critical mass of leading researchers actively addressing industry research challenges with world-scale resources. WAERA builds on core R&D with industry partners, including Woodside Energy Ltd (Woodside), Chevron Australia Pty Ltd (Chevron) and Shell Development (Australia) Pty Ltd to underpin the collective knowledge, skills and facilities necessary to meet the current industry challenges and lay the foundation for future energy developments". Partnership between UWA, Curtin and CSIRO.
- 11. Centre for Marine Science and Technology** Founded in 1985, the Centre for Marine Science and Technology (CMST) comprises a multi-skilled group of scientists and engineers committed to the development of technical ocean-related skills in Australia. The Centre has earned a reputation as a high-quality marine technology research and development facility responsive to industry and government needs. CMST's expertise fits into four major categories: Hydrodynamics, Underwater Acoustics, Marine Ecology and Stereoscopic Imaging.
- 12. Curtin Corrosion Engineering Industry Centre** Curtin Corrosion Engineering Industry Centre (CCEIC) conducts high quality research in areas of corrosion related to the petroleum, mining and chemical processing industries. CCEIC is equally actively engaged in short term R&D problem solving projects, typically of 1-6 month duration. CCEIC services to industry extend into fit for purpose qualification of materials and chemicals, evaluation of corrosion inhibitors, microbiologically influenced corrosion (MIC), corrosion under insulation (CUI), under deposit corrosion (UDC), top and bottom of the line corrosion and testing to Australian and international standards.
- 13. Sino Australian Joint Research Centre for Ocean Engineering** The Sino-Australian Joint Research Centre is a collaboration between Curtin University, Ocean University of China and Qingdao National High-tech Industrial Development Zone. It encompasses marine, subsea and ocean engineering and technologies.
- 14. Centre for Infrastructural Monitoring and Protection** CIMP will target and solve such challenges across a broad range of important applications; e.g. climate change adaptation for civil infrastructure, hazard mitigation, structural condition monitoring, structural design to resist blast and earthquake loading, and structure rehabilitation and protection.
- 15. CRC for Spatial Science 2 (CRCSI2)** We are a collaborative research centre. We push the frontiers of spatial science in partnership with university researchers, government agencies, the private sector and international organizations.
- 16. Innovation Central Perth (Collaboration with Cisco)** A unique collaboration of industry leaders has joined forces to drive digital innovation. Our mission is to champion a new generation of innovation and help create the digital success stories of tomorrow. Sharing a common goal of driving innovation in Australia, Cisco has come together with partners Curtin University and Woodside Energy.

University of Western Australia

- 1. Centre for Transformative Work Design (CTWD)**

The CTWD is a new centre at the University of Western Australia. Their vision is to transform work to create better lives for workers, better outcomes for organisations, and a better society for all.
- 2. UWA Centre for Energy**

The UWA Centre for Energy is an internationally reputable research facility in fuels, energy and sustainable development. The Centre's overall aim is to develop new knowledge and advanced technologies for efficient, effective and environmentally friendly utilisation of fuels and energy in the resources industries.
- 3. Microelectronics Research Group**

The MRG undertakes world-leading research in the areas of compound semiconductor device design, simulation, fabrication and characterisation. The group has wide-ranging capabilities in the areas of HgCdTe-based high-performance infrared sensors, AlGaIn/GaN-based ultraviolet sensors and high-speed high-power electronics, compound semiconductor growth by Molecular Beam Epitaxy (MBE), microelectromechanical systems (MEMS), and atmospheric electro-optic propagation.
- 4. The International Centre for Radio Astronomy Research (ICRAR)**

We are a joint venture between Curtin University (Curtin) and The University of Western Australia (UWA), with funding support from the State Government of Western Australia. ICRAR has research nodes at both universities and is now host to over 100 staff and postgraduate students. Since our launch, ICRAR has played an integral role in the development of the SKA project and has grown into an internationally renowned, multi-disciplinary research centre for science, engineering and data intensive astronomy.
- 5. Quantum Dynamics and Computation Research Group**

The quantum dynamics and computation group conducts research in the areas of quantum dynamics, quantum information processing, and quantum computation. In addition to using advanced mathematical methods and numerical techniques to model the dynamics of quantum systems and to investigate quantum algorithms, the group also has extensive HPC and computer algebra expertise to solve a wide range of science and engineering problems.
- 6. UWA Center for Safety – Submarine Endurance**

It's no doubt that submarine teams work and live in one of the most unique and challenging environments in the world. With the Royal Australian Navy, C4S researchers are helping to determine what work should look like for submariners on board the new high-tech submarines that will be built over the coming decades.

While new technology means greater opportunities for automation, it is important to protect against fatigue and optimise performance. Researchers are attempting to do this by understanding the factors that impact upon submariner endurance. Considerations include submariners' workload, skill utilisation, circadian entrainment and attentional demands.
- 7. Australian National Fabrication Facility -WA Node at UWA**

The WA node is based at the University of Western Australia, Crawley. It incorporates the Microelectronics Research Group (MRG) in the School of Electrical, Electronic & Computer Engineering, led by Prof Lorenzo Faraone. The MRG provides a wealth of knowledge on advanced microelectronic, optoelectronic, and photonic materials, devices and systems. The node runs a completely vertically integrated facility, from materials growth, through device design, fabrication and testing, to packaging and subsystem assembly.
- 8. Australian National Facility for Ocean Gliders**

The Australian National Facility for Ocean Gliders (ANFOG) is a facility of the Australian Integrated Marine Observing System (IMOS) and is responsible for the operation and maintenance of the ocean glider fleet.
- 9. Complex Data Modelling Research Group**

Using innovative techniques, we develop mathematical, statistical and computational methodology to support engineering projects. Our research focus is on the challenges of model-building, in the face of engineering data – big or small.

10. Frequency and Quantum Metrology Research Group	We aim to build instruments with world-class precision and performance that we can use to make measurements of high value and interest in both fundamental physics and more practical applications.
11. Big Data Processing and Mining Research Group	Our aim is to develop new techniques and systems to manage and make sense of big data.
12. Centre for Intelligent Information Processing Schemes	The Centre's mission is to be a national resource for research, consultancy and postgraduate studies in the area of intelligent information processing. It is active in the areas of intelligent systems, artificial neural networks, biomedical engineering, control, digital signal processing, parallel and distributed computing, image processing, pattern recognition, software engineering, spoken language systems, embedded systems.
13. UWA Oceans Institute	The UWA Oceans Institute engages in fundamental and applied research to support evidence-based decision making. Our collaborations are the key to addressing the challenges facing our oceans, coasts and estuaries.
14. WA Energy Research Alliance	WAERA delivers direct access to a critical mass of leading researchers actively addressing industry research challenges with world-scale resources. WAERA builds on core R&D with industry partners, including Woodside Energy Ltd (Woodside), Chevron Australia Pty Ltd (Chevron) and Shell Development (Australia) Pty Ltd to underpin the collective knowledge, skills and facilities necessary to meet the current industry challenges and lay the foundation for future energy developments". The Alliance forms the basis of a successful research partnership between UWA, Curtin and CSIRO.
15. Pawsey Supercomputing Centre	The Pawsey Supercomputing Centre operates multiple supercomputers, data-intensive machines and storage systems that use the most advanced technologies available.
16. UWA Indian Ocean Marine Research Centre	The Indian Ocean Marine Research Centre is a collaboration that brings together four of Australia's leading research organisations working in and around the Indian Ocean" These are the Australian Institute of Marine Science, CSIRO, Department of Fisheries WA and The UWA Oceans Institute.
17. Australian Research Council Research Hub for Offshore Floating Facilities	The Industrial Transformation Research Hub for Offshore Floating Facilities (Offshore ITRH) is a multi-disciplinary research initiative jointly funded by industry and the Australian Research Council. We are collaborating on the critical engineering challenges faced by offshore oil and gas projects by creating improved design and operating procedures. We are based at the University of Western Australia, with a node at Western Sydney University.
18. Centre for Offshore Foundations/ National Geotechnical Centrifuge Facility	The National Geotechnical Centrifuge Facility (NGCF) is a world-leading geotechnical centrifuge modeling facility that brings together six Australian universities working on a wide range of geotechnical problems, both offshore and onshore.c

Edith Cowan University

- 1. Centre for Innovative Practices** The Centre for Innovative Practice is located in the School of Business and Law. The Centre's research focuses on developing innovative practices across a wide range of professions and organisations within the business and law sectors.
- 2. Electron Science Research Institute** The Electron Science Research Institute (ESRI) carries out fundamental and applied research in microelectronics and photonics and ventures into related areas of nano-technology to develop novel integrated intelligent structures for applications in the ICT, Health, Agri-bio, Security, Sensing, Defence and Environment sectors.
- 3. Centre for Communications and Electronic Research** The Centre for Communications and Electronics Research (CCER) conducts high quality research in the fields of optical, wireless, optical and multimedia communications. Our centre has particular interest in applied research areas such as wireless sensor networks with applications in environmental monitoring, voice and voice over IP, green communications, next generation wireless broadband networks (i.e. 5G), smart energy systems, sensors and devices, frequency selective surfaces, 2D barcodes, and structural health monitoring.
- 4. Centre for Marine Ecosystem Research** At the Centre for Marine Ecosystems Research (CMER) we use applied and fundamental research to improve our understanding of the ecological processes of coastal marine systems, and how these respond to both natural and human induced pressures.
- 5. ECU Security Research Institute** With a reputation as one of the leading digital security and forensic groups in world, the ECU Security Research Institute has emerged as one of ECU's most vital research groups. We offer a range of investigating study areas that deliver immediate and high impact outcomes in the areas of computer and digital forensics, network and wireless security, information warfare, physical security, risk management and aviation security.
- 6. Australian Cyber Security Research Institute** The Australian Cyber Security Research Institute (ACSRI) seeks to support the Australian Government's focus on this growing problem by bringing together a collaborative network of researchers, universities, government and industry partners nationwide. Representing Australia's first coordinated strategic research and education effort between national cyber security agencies, industry and researchers, ACSRI will deliver an Australia-wide approach to respond to cyber threats and cyber crime.

University of Notre Dame Australia

- 1. Institute for Health Research** As one of three Institutes established by Notre Dame University to provide leadership in collaborative research initiatives, the Institute for Health Research (IHR) is located in Fremantle. Drawing on the clinical expertise within the Schools of Health Science (biomedicine, outdoor recreation, health and physical education, preventive health, and exercise and sport science), Medicine, Nursing & Midwifery and Physiotherapy, the IHR seeks to facilitate and promote health-related research at a post-graduate level.

Sources: University of Western Australia, Murdoch University, Curtin University, Edith Cowan University and Notre Dame University.

Appendix B: Defence C4ISR Investment Programs

Programs	Summary
1. Military Satellite Capability	The Australian Government to acquire a Military Satellite Capability through \$507 million of funding allocated in the 2016 DWP to enhance Australia's satellite communications operations and its overall communications capability.
2. Common Operating Picture Capability Program	The Common Operating Picture Capability Program will provide situation awareness capability to provide for more effective decision making and mission execution within the ADF with investment in the program to total around \$500 to \$600 million over the program's timeframe of 2017-2033. The program will also see Defence continue functionality enhancements to relevant systems to integrate the common operating picture at all levels and provide enhanced situational awareness across the joint force.
3. Position, Navigation and Timing Capability	Upgrades have also been envisioned over the period 2019-2033 of \$750 million to \$1billion to enhance the ADF's position, navigation and timing capability to improve operational effectiveness.
4. Air Operations Centre	\$750 million to \$1billion have been allocated to Australia's Air Operations Centre over the period 2022-2029.
5. Digital Topological Systems Upgrade	Investment of \$87 million has been approved for upgrades to Australia's Digital Topological Systems.
6. Intelligence Systems	Intelligence systems across the board will see investment upgrades worth \$2-3 billion over the period of 2016-2031.
7. Intelligence Surveillance and Reconnaissance Information Integration and Optimisation	Intelligence Surveillance and Reconnaissance Information Integration Optimisation systems will see \$300 to \$400 million of investment over the period 2016-2029.
8. Enhanced Geospatial Information, Infrastructure and Services Program	Upgrade investment to Australia's enhanced Geospatial Information and Infrastructure capabilities are envisioned to the approximate tune of \$200 to \$300 million over the period 2016 to 2025.
9. High Altitude Unmanned Intelligence Surveillance & Reconnaissance System	From the early 2020s, Defence will acquire an advanced surveillance system comprising seven MQ-4C Tritons, with supporting intelligence, surveillance and control systems. Funding for the supporting systems of these High Altitude Unmanned Aircraft was scheduled for approval in FY 2015-16 and likely be worth less than \$100 million.
10. Tactical Data Links Information Exchange Capability	Upgrade investment to Australia's tactical data link and information exchange capability through functionality enhancements to relevant systems in order to provide enhanced situational awareness across the joint force is envisioned to the value of \$750 million to \$1billion between the period of 2016-2031.

11. Vigilare Air Surveillance System Upgrade	The Vigilare Air Surveillance System earmarked also for capability enhancement under the 2016 DWP's overall suite of upgrade measures to Australia's current air defence network.
12. Jindalee Operational Radar Network Upgrade	Upgrades to Australia's air defence network through a spiral development program into the 2030's worth \$1-2 billion over the program timeframe of 2017-2026. The program will see the Jindalee Network reach its full potential with its wide area surveillance capability.
13. Space Situation Awareness Partnership with the United States	This program continues to strive for success with the establishment of a space surveillance C-Band Radar which is jointly operated between the two countries and the relocation of a US Space Surveillance Telescope to the Harold E. Holt Naval Communications Station near Exmouth, WA. Funding for enhancements to the Jindalee Operational Radar Network is put at \$1-\$2 billion over the program's timeframe of 2017-2026.
14. Long Range Electronic Warfare Support Aircraft	Through the Long Range Electronic Warfare Support Aircraft Program, Defence envisions acquiring up to five long range electronic warfare support aircraft based on the Gulfstream G550 airframe with this newly acquired capability expected to substantially enhance electronic warfare support to naval, air and land forces for operations in electromagnetic environments manipulated by hostile forces, with the operating cost, range and endurance benefits of a commercial airframe. The program sets aside \$2-3 billion over the period 2017-2024.
15. Electronic Warfare Operation Support	Defence continues to envision the "acquisition and delivery of a force-level, electronic warfare capability, through a suite of projects to achieve high levels of information fusion and comprehensive planning across the joint force and Defence intelligence agencies". Over the period 2019-2030, \$100-\$200 million have been set aside for the program.
16. Joint Electronic Warfare Integration Program	This program sets aside funding of \$400 to \$500 million over the period 2016-2033 allowing the ADF to enhance its ability to control the electronic environment and degrade the electronic systems of adversaries.
17. Enhanced Electronic Warfare Operational Support	This program envisions funding over the period 2019-2030 of between \$100 million and \$200 million.
18. Cyber Security Capability Improvement	In order to meet the growing cyber threat to Australia's national security and economic prosperity, Australia will further develop its cyber security capability to ensure it can deter and defend against an increasingly complex array of threats. The program allocates funding over the period 2016-2025 of \$300-\$400 million.

Sources: 2016 Defence White Paper, 2016 Defence Integrated Investment Program. FitzGerald, Annaliese. "DWP 2016: the future of C4ISR". Australian Strategic Policy Institute, The Strategist. March 4, 2016.



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