



Northrop Grumman's Contribution to Australia



29 April 2022

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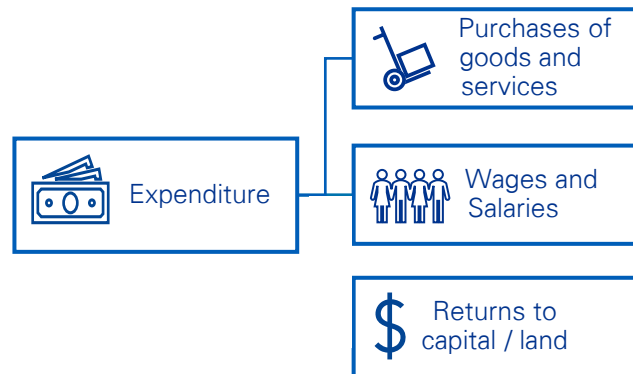
Contents

Impact at a glance	i
1. Introduction	1
2. NG Australian operations	4
2.1 Building Australian industry and skills.....	5
2.2 Operational contribution	5
3. NG Australia’s national impact	8
3.1 Stimulating domestic business activity	9
3.2 Global supply chains	9
3.3 NG Australia’s economic impact	10
4. NG Australia is part of the Australian community	13
Women in industry.....	14
Community outreach	14
Indigenous inclusion	15
Veteran support	15
5. NG Australia is bringing global technology to Australia now	16
6. NG Australia is developing the future sovereign capability	20
7. Beyond policy	26
Appendices	28
Appendix A: KPMG-CGE model.....	29

Impact at a glance



Over the four years to 2020, Northrop Grumman spent over **\$1 billion** in the Australian economy



Every year, Northrop Grumman (NG) makes significant and growing contributions to the Australian economy, with



\$112 million spent on Australian employees in 2020 – increasing by 50% since 2018, **plus**



\$256 million spent on inputs into NG Australia activities – increasing by 35% since 2018.



NG Australia's **employment** footprint is growing, **increasing by 40%** in the past three years.

NG Australia is building Australian industry for the future



Another \$78 million spent on Australian businesses in 2020 through the NG global supply chain, up from \$40 million in 2017, with over **\$330 million** across those four years.

Northrop Grumman currently supports over **1,468 jobs** and

\$252 million



in annual Australian Gross Domestic Product (directly and indirectly, 2020 est.)



Value-added/
Direct GDP
contribution

NG Australia is part of the Australian community

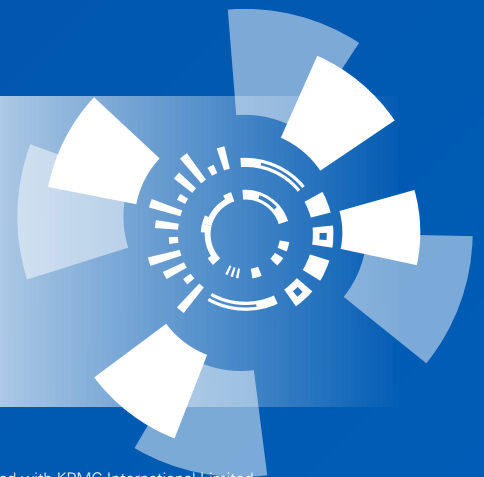


From 2017 to 2021, NG Australia invested **\$2.1 million** in research, sponsorships, scholarships, charities and social programs across Australia.



NG Australia has developed **65 Australian partnerships** with universities, STEM events, Government, small to medium enterprises, charities and non-government organisations.

In addition to direct impacts, NG Australia activities support industry, provide ongoing opportunities for a skilled workforce and further Australian sovereign capabilities.





1. Introduction

Over the last two decades in Australia, Northrop Grumman (NG) has grown to become a trusted provider of aerospace, integrated systems and technologies to the Australian defence sector. This rapid development is leveraged on NG's proud global history of designing complex integrated systems, from the Lunar Module for the Apollo Lunar Missions six decades ago through to today's B-21 Long Range Strike Bomber and James Webb Space Telescope. Northrop Grumman Australia (NG Australia) is well placed to contribute to Australia's important strategic task of developing its sovereign industry capabilities in both the defence and space sectors.

NG Australia's operations and strategic investments have been growing rapidly over the last two decades, most notably from a strong base of providing sustainment to a range of ADF platforms. As Australia's strategic environment becomes more complex, and Australia strengthens its defence industry collaboration with key allies, notably through the trilateral security pact between Australia, the United Kingdom, and the United States (AUKUS), technological release is a key driver of capability and success. As a leading global defence and aerospace contractor, NG has a long and ongoing history in the development of complex, integrated systems. NG can leverage this experience and capability to assist Australia in establishing and developing sovereign industry capabilities in key areas of future defence and space technology.

Given the strategic context, speed to market is becoming increasingly important, and NG Australia's expertise with critical technology areas will support the timely and efficient delivery of cutting-edge capabilities, future upgrades and additional integrated elements. The development of AUKUS as a key technology transfer mechanism for the sharing and development of future defence capabilities between Australia and two of its closest allies will highlight the importance of the role of experienced industry partners to deliver complex outcomes and leverage intellectual property, and research and development (R&D) from tested areas of innovation.

KPMG was engaged by NG Australia to provide an analysis of the economic contribution of NG's business to Australia and to provide a better understanding of what NG Australia has achieved to date and what it is looking to achieve in the future, a future where effective industry collaboration with government is becoming increasingly important. This report contains the outcome of that analysis, examining the direct and indirect economic contributions made by NG Australia, going beyond operational activity to also consider skills and technology transfer, industry partnerships, strategic impact and sovereign supply chain growth.

The current slow-down in economic activity, resulting from the prolonged impact of the global COVID-19 pandemic, underlines the need for Australian businesses to be agile and have the ability to deliver swiftly, particularly in the context of rapidly developing technology and the pressing imperatives of Australia's strategic circumstances. This report illustrates NG Australia's commitment, experience and capacity to deliver innovation to the Australian Defence Force (ADF) that will continue to support the safeguarding of Australia's national interests.

Current examples of NG Australia’s contributions include:

- Continued to support the sustainment of Australia’s defence capabilities, including mid-air refuelling and transport. **Investment in sustainment programs offer important skills development and career opportunities, vital to Australia’s long-term workforce capability.**
- Bringing advanced technology and skills to Australia through products such as the Triton. By providing Australia with **access to advanced technology**, this not only **provides increased capability now, but also provides new supply chain and skill transfer opportunities to Australian industry.**
- Developing partnerships and support for Australian R&D, such as through NG Australia’s memoranda of understanding with Queensland-based rocket company, Gilmour Space Technologies. By **supporting Australia’s research pipeline across all stages of technology readiness, NG Australia is helping facilitate the new Australian technological innovations necessary to advance a more capable sovereign industry.**
- A demonstrated history and future commitment to its strategic partnership with Defence through programs such as Joint Project 2008 (JP2008) Phase 5B2. Under this program Australia will acquire a proven communication-secured software platform that is tailored to the needs of the ADF, and that can evolve over time to adapt to new technology. NG Australia is committed to **bringing world class capacities onshore** where solutions exist, and to support **Australia’s own technological breakthroughs**, which also support **new skill and business development.**
- Working as a partner to many community organisations. By investing in sponsorships, scholarships, charities and social programs across Australia, NG Australia is **providing financial support and direct opportunities to the next generation to drive growth in Australia’s highly skilled workforce.**

NG is working with Australia to help sustain its sovereign interests and, as part of this, is leveraging NG’s deep history in advanced defence and space technology.



Chris Deeble AO CSC, Executive Director of Strategy (NG Australia) and the Minister for Defence Industry, the Hon. Melissa Price MP open NG Australia’s Parallax Labs in Symonston Canberra.

2. NG Australian operations



NG Australia provides a significant, measurable contribution to the Australian economy through its onshore operational activity, and through the participation of Australian businesses in NG's global supply chains. This section looks at the **direct economic contribution of NG** to the Australian economy based on its operations in 2020.

2.1 Building Australian industry and skills

Through its growth in capability sustainment activities in Australia, NG is supporting Australian industrial capabilities and skills.

The foundation of NG's investment in Australia has been through its Sustainment program, which helps maintain defence capability and contributes to Australia's sovereign defence industry. Since the acquisition of Qantas Defence Services in 2014, NG Australia has grown the Sustainment program and has partnered with small to medium enterprises (SMEs) to jointly resolve a number of technical challenges to support the ADF mission.

Key defence capabilities currently being maintained through life by the NG Australia sustainment program include:

- C-27J Spartan battlefield airlifter fleet
- KC-30A Multi-Role Tanker Transport (MRTT)
- Commonwealth's special purpose aircraft (SPA) VIP fleet.

The Sustainment program supports numerous Through-Life-Support (TLS) contracts and provides opportunities for Australia to attract, retain and develop an onshore workforce with the capability to design, adapt and maintain the aircraft fleet. NG Australia provides careers for talented engineers including apprenticeships and cadetships, as well as the opportunity to further their career through extensive ongoing training and development.

2.2 Operational contribution

Over the four years to 2020, NG spent over \$1 billion in Australia.

NG Australia operations supported 723 direct full time equivalent (FTE) jobs in Australia (as at September 2021). Through the long-term nature of activities, NG Australia supports career development.

Across NG Australia, the employment footprint has been growing strongly, increasing by 40% in the past three years.

NG Australia directly employed 513 FTE workers in 2018, which increased to 661 FTE workers in 2020 and provided \$112 million in employee incomes in Australia. NG Australia currently employs 723 FTE workers across Australia in 11 locations (as at 10 September 2021).



Source: Northrop Grumman Australia



CASE STUDY 1:

Sustainment of air-to-air refuelling and strategic airlift capability

NG Australia is supporting the growth and development of our aviation sector. Investment in sustainment programs provide skills development and career opportunities, vital to Australia's long-term workforce capability.

The KC-30A MRTT enables the Air Force to conduct air-to-air refuelling and provide strategic air mobility. Under this TLS contract, NG Australia has the important task of maintaining the fleet of seven KC-30A aircraft, supporting the Royal Australian Air Force (RAAF) flying out of RAAF Base Amberley.

Capability sustainment: Through-Life-Support

The 18-year KC-30A TLS contract with rolling wave extensions, alongside other TLS contracts (including C27J and SPA), provides NG Australia the confidence to make long-term investments in Australia. NG Australia has made strategic investments in building up and building out capability.

Starting with an initial acquisition of Qantas Defence Services in 2014, NG Australia has continued to develop its services through infrastructure improvements, such as an \$18 million investment in maintenance facilities at the Brisbane Maintenance and Modification Centre. These types of investments build Australian sovereign industry capability in Aerospace platform deep maintenance, which was identified as one of the initial Sovereign Industrial Capability Priorities (April 2018).

The certainty and long lead time for the upgrade of aircraft platforms and supporting equipment enables local suppliers, including SMEs, to build

relationships with original equipment manufacturers for future replacement and upgrades. This pathway provides knowledge and skills transfer to Australia from European Union and United States (US) manufacturers. The ongoing commitment to local suppliers provides the scale necessary to support local industry and engage the local supply chain.

Economic Benefits

The KC-30A TLS program provides ongoing support to Australian sovereign defence and aviation industries. This program generates annual revenue of around \$150 million, benefiting the Australian economy through both local NG Australia employment and purchases from local suppliers.

Growing from a modest workforce of 50 in 2014, there are currently 250 people employed directly by NG Australia to support the KC-30A program. NG Australia also engages Australian businesses, with \$18 million spent across more than 110 local suppliers in 2019-2020. Around two-thirds of these suppliers are SMEs. As the aircraft age and capabilities evolve, greater ongoing support is required and the benefits to Australian industry will grow. NG Australia also offers mentoring to help Australian suppliers become 'Defence ready', such as participating in the Ipswich City Council Operation Scale-Up 2021 program.



3. NG Australia's national impact

In addition to directly contributing to Australian employment and expenditure through its operations, NG Australia also contributes to the Australian economy through supporting Australian businesses (as illustrated in the KC-30A case study). Australian businesses supply inputs to the domestic activities of NG Australia and participate in NG's global supply chains. This section estimates **NG's overall economic contribution to Australia**.

3.1 Stimulating domestic business activity

NG Australia's purchases of goods and services, and expenditure on wages, drives a second wave of activity in the Australian economy, stimulating further activity up and down the supply chain.

NG Australia's operational expenditure also stimulates activity in the businesses that supply goods and services to NG Australia and to NG Australia's employees. These businesses, in turn, purchase goods and services and employ workers, which stimulates more activity up and down the supply chain. Thus, NG Australia's contribution to the Australian economy is not limited to the direct impacts, with these supply chain effects providing additional 'indirect' contributions.

Table 1: Direct contribution of NG Australia's onshore operations (2020) **AUD million**

	AUD million
Expenditure	368.8
Purchases of goods and services	207.2
Wages	112.6
Other	49.0
Value-added	121.6
Direct employment (FTE jobs)	661 (2020) 723 (at Sept 2021)

Source: KPMG estimates based on Northrop Grumman data.

3.2 Global supply chains

Operating locally, thinking globally – Australian businesses are achieving global success through the international reach of NG.

In addition to NG Australia's onshore operational expenditure, Australian businesses are engaged in NG's global supply chain. In 2020, Australian businesses provided over \$78 million in goods and services internationally to NG, primarily in advanced manufacturing. NG provides some of the world's most advanced products and services to 25 countries. Participation in this supply chain provides these companies with international exposure, which could lead to further opportunities for these businesses.

Table 2: NG's global supply chain expenditure in Australia (2020) **AUD million**

	AUD million
Specialised and other Machinery and Equipment Manufacturing	51.2
Professional, Scientific, Computer and Electronic Equipment Manufacturing	19.3
Other Fabricated Metal Product Manufacturing	7.4
Computer Systems Design and Related Services	0.7
Total	78.6

Source: Northrop Grumman

Industries in Table 2 are labelled according to the standard Australia New Zealand Industry Classification (ANZSIC).

It should also be noted that the estimates above are conservative, capturing the export sales from a sample of seven Australian exporters in the NG deep supply chain in 2020. The overall total is likely to be higher than these figures indicate.

3.3 NG Australia's economic impact

To understand the total quantifiable economic contribution of NG Australia operations and global supply chain activity, the direct in-country expenditure and global supply chain expenditure have been applied to a detailed economic model of the Australian economy (see details in Appendix A). This captures the flow-on impacts along the supply-chain such as wages and goods and services purchased by businesses supplying NG Australia.

The total economic contribution has been modelled using KPMG-CGE, an in-house detailed computable general equilibrium (CGE) model of the Australian economy that captures linkages between all sectors of the economy, and the behaviour of economic agents, including households and businesses (further details are in Appendix A). The figure on the right shows a conceptual view of the economic impacts estimated through the economic model.



NG Australia's activities are estimated to have contributed \$252 million to Australia's Gross Domestic Product (GDP) in 2020 and supported 1,468 jobs. This investment is planned to grow.

NG Australia's operational activity and the NG global supply chain spend in Australia is estimated to have contributed \$252 million to Australian GDP in 2020 (Figure 1). This consists of \$122 million in direct value-added, plus an additional \$130 million stimulated through supply chains with Australian businesses and employee expenditure.

NG Australia's in-country activity also stimulates additional employment in the Australian economy. **It is estimated that NG Australia activities supported 1,468 FTE jobs in Australia in 2020,**

inclusive of the 661 FTE workers directly employed by NG Australia in 2020 (noting that this direct FTE figure has grown significantly to 723 by September 2021), indicating a further 807 FTE jobs are supported through indirect supply-chain activity.

The estimated impacts of NG Australia's activity vary across sectors (using the standard Australian ANZSIC industry classifications), as shown in Figure 2, below.

The in-country operational activity of NG Australia brings a significant boost to the *Aircraft maintenance and manufacture* sector and to the *Computer systems design* sector. *Electronic equipment, Other manufacturing* and *Professional, technical and scientific services* in Australia are further stimulated through demand from NG globally.

Figure 1: Northrop Grumman Australia annual economy-wide impacts, 2020 (\$m)

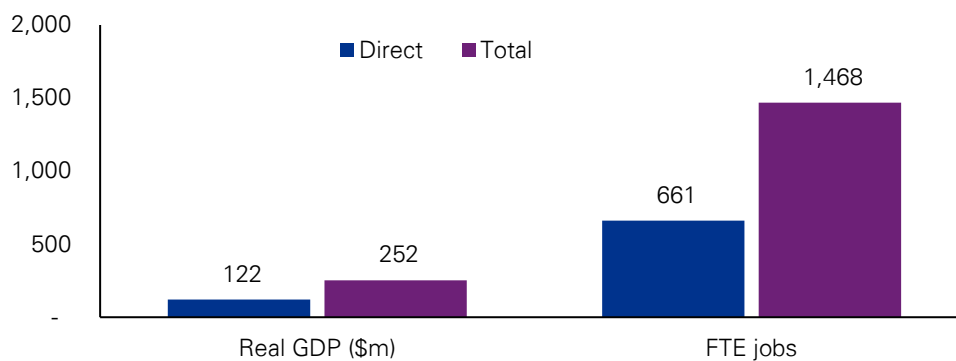
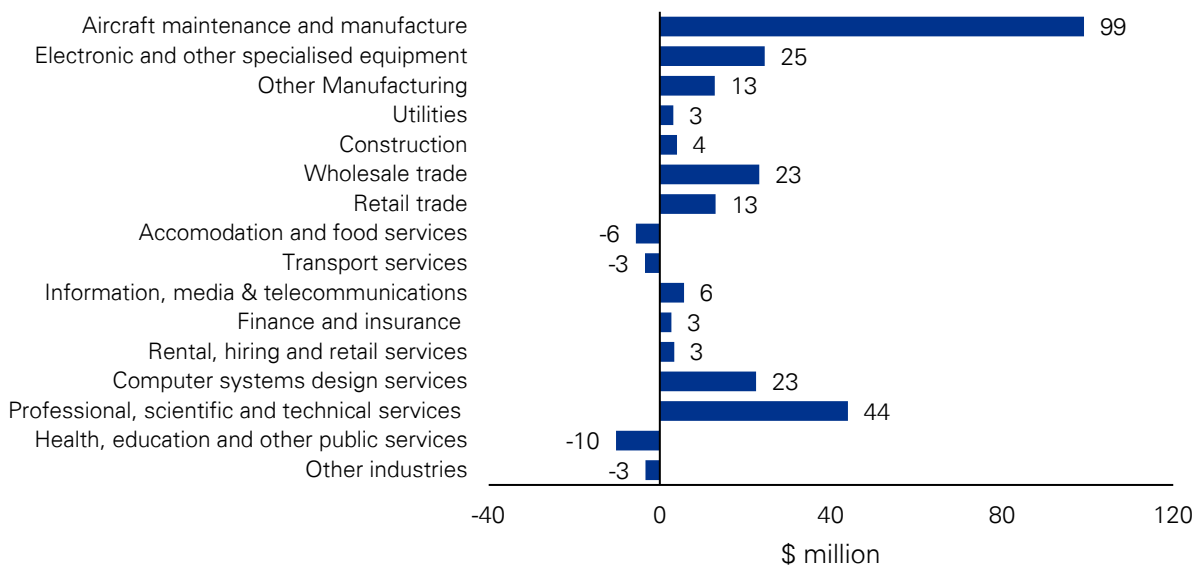


Figure 2: Industry value-added, 2020 (\$m)

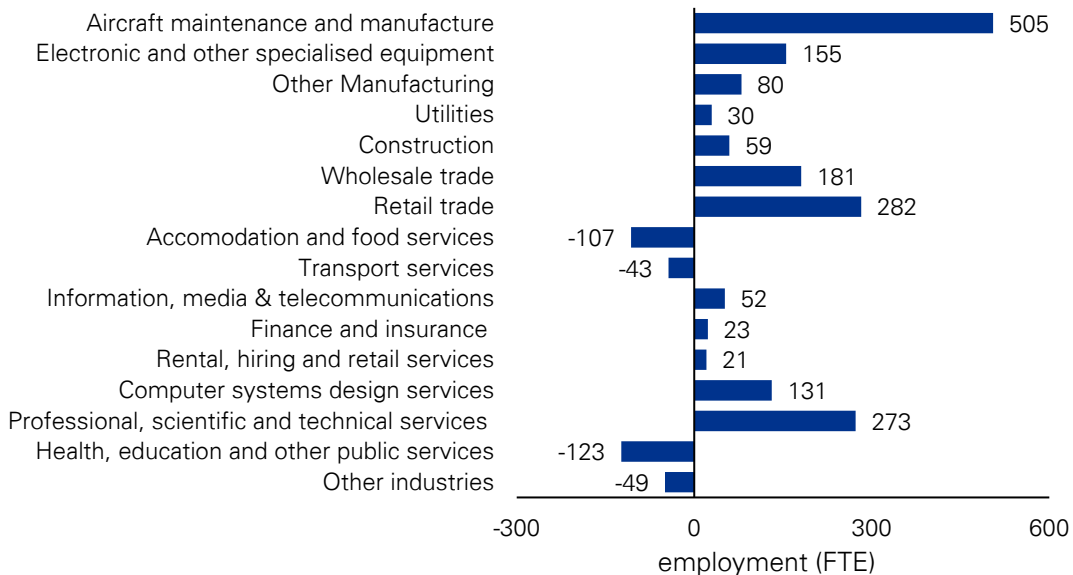


This direct activity will stimulate additional indirect economic activity up and down the supply chains. This brings a boost to sectors that support NG Australia's operational activity and/or the businesses in the global supply chain, such as *Wholesale trade, Professional services, and Information, media and telecommunications*. With higher employment and wages, there is also additional activity in industries, such as *Retail trade and Other manufacturing*, which are purchased by consumers. Some sectors experience a small decline due to a re-allocation of resources to support NG Australia and associated activities,

but there is a strong positive impact for Australian businesses overall.

Figure 3 reports the sector breakdown of total jobs stimulated in the Australian economy. These jobs largely reflect the value-added impact, with most occurring in the *Aircraft maintenance and manufacture, Electronic and other specialised equipment, Wholesale and retail trade, and Professional services* sectors. While the pattern is generally similar to the value-added impacts, because of differences in labour intensity, some sectors will show stronger employment impacts relative to the change in value-added.

Figure 3: Annual industry employment in Australia, 2020 (FTE jobs)



While these financial measures are significant, they are only one facet of NG Australia's contribution to Australia, which goes beyond these measured economic impacts. NG Australia is investing in growing future Australian industry and sovereign capabilities, with a focus on building a skilled workforce, and providing access to global opportunities both directly for NG Australia employees and indirectly for Australian businesses in the supply chain.

The remaining sections of this report look at the different ways that NG Australia is investing in, partnering with, and supporting Australian communities, workers, industry and Defence.



This artwork is by Chern'ee Sutton. It represents Northrop Grumman Australia's commitment to its Reconciliation Action Plan Journey.

4. NG Australia is part of the Australian community

Including active contributions in 2021, over the past five years NG has invested \$1.6 million in sponsorships, scholarships, charities, and social programs across Australia. NG Australia also provides financial support and direct opportunities to the next generation to drive growth in Australia's high-skill workforce.

NG Australia is a partner to many community organisations and specifically targets charities and university programs that focus on supporting women in Science, Technology, Engineering, Mathematics (STEM), Indigenous education, mental health and continuing support to the veteran and service member community. These span all ages in the community, from school-based STEM outreach, such as CyberTaipan, supporting students during university and transition to work, through to support for veterans, such as the Veterans Support Centre. Community organisations support those in the workforce as well as those returning service women and men and their families.

Women in industry

NG Australia is supporting women in STEM with practical programs that provide direct assistance, as well as encouraging greater female participation in the sector.

We have highlighted two of NG Australia's programs. The first is giving women direct entry and support through NG Australia's Sustainment programs – the Female Aircraft Maintenance Engineers (FAME) program (working with Aviation Australia) is dedicated to increasing female participation in aircraft maintenance engineering across Australia. The program gives clear career pathways, offering women an opportunity at an early age to increase their participation in the industry. It offers practical support through opportunity and mentorship in the industry, work experience and a professional network of women.

The second program, with the University of New South Wales (UNSW), targets early participation in STEM as a career by offering a series of free workshop-based programs to inspire future engineers. More than just direct hands-on programs, it also offers mentorship and direct engagement with female engineers at the head of their respective fields in a class filled with like-minded young women.

Across these initiatives, NG Australia has provided around \$100,000 directly to women in STEM. This includes the UNSW 'Women in Maths Prize' as well as the Sydney University Women in Engineering Aerospace Prize.

Community outreach

NG Australia supports first responders and mental health services to improve the wellbeing of Australian communities.

The Royal Flying Doctor Service (RFDS) are first responders providing healthcare to over 1,000 people in Australia every day. NG Australia is supporting the RFDS undertake vital avionics upgrades for Beechcraft King Air B200 aircraft tasked with emergency retrieval services. The upgrades aim to improve emergency response times and the RFDS' ability to reach more individuals. Upgrading just one aircraft means the RFDS can help more than 500 additional patients.

NG Australia supports Lifeline Australia and their work in helping Australians suffering from mental health issues at difficult times. In addition to providing \$20,000 support in 2021, NG Australia is working with Lifeline Australia to understand the benefits of volunteer work for both the community and the mental health of volunteers. NG Australia employees are entitled to one day of social responsibility volunteering leave per annum.

Further supporting mental health, NG Australia also participated in the One Foot Forward walk for mental health by Black Dog Institute, with \$13,000 raised by NG Australia employees and their community in 2021.

Indigenous inclusion

NG Australia is enhancing the next generation of the workforce by encouraging the participation of **Australia's First Nations Peoples**, with initiatives such as an annual 'Best in Science, Technology, Engineering and Mathematics' Prize for an Aboriginal and Torres Strait Islander student.

Education is the key to generational change and a brighter future for Indigenous children. Yalari has been educating and empowering children since 2005. It offers direct scholarships to Indigenous children studying nationwide. Yalari is led by Indigenous educators to support Indigenous children. More than simply direct financial assistance, it offers a network of schools and universities as well as alumni to offer mentorship across the community.

NG Australia contributes to this program to support and grow the future Indigenous engineer workforce. NG Australia also offers direct financial support to Indigenous students at the Australian National University through the National Indigenous Summer School Program. Offering these multi-channel supports allows NG Australia to support both talented Indigenous students as well as future leaders.

NG Australia's vision and commitment is reported in their Reconciliation Action Plan August 2019 – July 2021. It outlines their actions to date, and their aspirations, such as building trust and respect in their relationships with Aboriginal and Torres Strait Islander peoples.

Veteran support

NG Australia has a strong direct connection to the veterans community and supports key programs that offer direct support to veterans, and their families.

NG Australia is a 'Pledge partner' of Soldier On, reflecting NG Australia's commitment to veterans and their families. In collaboration with the Soldier On Pathways Program, Pledge companies help support veterans and their families to secure their future careers. This program provides services, including health and wellbeing support, employment and transition support, learning and education as well as social inclusion programs. These services expand to a wide range of people, including serving and ex-serving veterans and their families.

NG Australia also provides local support for the Australian War Memorial located in the Australian Capital Territory (ACT), Vietnam Veterans and Veterans Federation ACT (Veterans Support Centre). In addition, NG Australia provides continued ongoing support for Legacy, which in turn supports families suffering the loss of life through protecting Australia. Legacy offers vital financial support to families suffering financial hardship, connects families in the veteran community, and gives them development opportunities to grow through education.



5. NG Australia is bringing
global technology
to Australia now

The defence industry is focused on developing identified Sovereign Industry Capability Priorities, as initially outlined in the 2018 Defence Industrial Capability Plan, extended in the 2020 Defence Strategic Update and 2020 Force Structure Plan and including the four additional priorities announced in August 2021. These priorities identify a range of capabilities which Australia must be able to develop, support and maintain.



NG has a proud history of developing advanced global technologies, from the Lunar Module for the Apollo Lunar Missions six decades ago, through to today's Long Range Strike Bomber and James Webb Space Telescope. Leveraging the strong US-Australia relationship, NG Australia has quickly grown to become a trusted provider of aerospace, technology transfer, integrated systems, and technologies for the Australian defence sector over two short decades.

This global expertise aligns well with the development of Australian capability under the four recently announced additional Sovereign Industry Capability Priorities:

- Robotics, Autonomous Systems, and Artificial Intelligence
- Precision Guided Munitions, Hypersonic weapons, and Integrated Air and Missile Defence Systems
- Space
- Information Warfare and Cyber Capabilities.

To advance Australia's sovereign capability and future security, Australia must invest in the latest technologies. NG Australia draws on its global expertise in the deep science and space sectors to help Australia build this critical capability foundation.

NG Australia is a key partner in enabling many of the sovereign industry capabilities identified by Defence. A practical example of how NG Australia is building next generation capability is through the Triton program, in which NG Australia is bringing the latest technology in unmanned aerial vehicles to Australia and supporting skill development, along with future sustainment of the capability.



CASE STUDY 2:

Triton: Developing SME capability and skills in Australia

NG Australia fosters the development of advanced technology and skills in Australia. By providing Australia with access to advanced technology, this not only provides increased capability now, but also provides new supply chain and skill transfer opportunities to Australian industry.

Boosting Australia's surveillance capabilities

The Australian Government has committed to purchasing three MQ-4C Tritons, which are uncrewed Aircraft Systems that have the capacity to survey vast areas in a single trip. The Government has also indicated the potential to increase this initial number to a fleet of seven, which would allow two simultaneous orbits of areas of interest, including the South China Sea.

Preparation for this capability is well underway, with the Triton Network Integration Test Environment delivered in September 2021 and construction of the first Triton expected to be completed in 2023. The automation and remote piloting of the Tritons complement existing capabilities provided by the crewed P-8A Poseidon currently used by the RAAF. This is an effective capability combination because the Triton can utilise its extensive endurance and range, while the P-8A Poseidon can focus on strengths in areas such as anti-submarine missions.

The Triton provides a significant boost to the nation's surveillance and reconnaissance capabilities. In addition to offering surveillance

flexibility (such as monitoring of oceans and other remote areas and collaboration with the surveillance operations of allies), the Triton has other non-surveillance uses (such as illegal fishing detection and natural disaster management).

Benefiting the Australian economy

The Triton is a major investment being made by the Australian Government, with approximately \$2.5 billion committed for acquisition of the aircraft and other project inputs. To support the ongoing sustainment of the Tritons, NG Australia will establish 150 skilled jobs in Australia - located between RAAF Edinburgh, South Australia as the main operating base and RAAF Tindal, Northern Territory as the forward operating base. These job roles will be focussed on both operating and sustaining autonomous systems, and on Intelligence, Surveillance, Reconnaissance and Electronic Warfare.

NG Australia is delivering advanced technical capability uplift through Triton's advanced technology. This gives Australia a vital boost to its sub-surface and surface surveillance requirements. Additionally, as

electronic warfare payloads are expected to evolve over the life of the Triton, Australian businesses could see further benefits through new supply chain and skill transfer opportunities.

Building Australia's industrial capabilities

The Triton is a cutting-edge technology and requires high standards of aviation construction and design. While the Tritons are primarily built in the US, NG Australia has worked with Australian businesses to incorporate them into the supply chain. This includes businesses such as:

- AME Systems in regional Victoria, which has achieved accreditation to provide wire harnesses to NG, which will be used in the Triton fleet. AME Systems are now one of only three companies worldwide that are certified to make this integral component for NG, which has provided the company with further opportunities in the broader defence industry.
- Ferra Engineering in Queensland, which has been manufacturing mechanical sub-assemblies since 2015.

The involvement of Australian companies in this high-value, global supply chain enables these companies to enhance their technical capabilities, position themselves to engage with large multinational defence companies (known as 'primes'), and supply goods and services to other hi-tech and sophisticated programs.

Overall, enhancing Australia's capability in aviation manufacturing and autonomous systems will not only benefit other technologies, but will also be highly transferable to other defence programs and related sectors.





6. NG Australia is developing the future sovereign capability

Creating a sovereign capability in industry takes a long-term focus, advanced technology, and deepening partnerships between research, industry and the ADF. Across all these components of success is the investment in 'human capital' to deliver programs.



The Defence Sovereign Industry Capability Priorities have been extended from 10 priorities, which focused on industry capability and the immediate future, to include the following additional four priorities, which aim at the next phase of development:

- Robotics, Autonomous Systems, and Artificial Intelligence
- Precision Guided Munitions, Hypersonic weapons, and Integrated Air and Missile Defence Systems
- Space
- Information Warfare and Cyber Capabilities.

With its decades of experience in delivering complex projects, NG Australia is directing investment and expertise to support Australia's sharpened focus on its sovereign industry capability priorities.

NG Australia's deep skill and expertise in delivering complex projects in the sector gives it the ability to focus investment where it is needed. As highlighted in Case Study 3, NG Australia has the capacity to invest across the entire technology research and development ecosystem in Australia. This case study demonstrates NG Australia's commitment to solving some of the critical barriers to developing sovereign capability in Australia's priority areas through investment at all stages of technological development.

Sovereign capability also requires investment in large systems of systems programs. The Parallax Labs, a \$20 million investment by NG Australia, is an example of this investment building collaboration between the ADF and Australian industry partners. This investment is not just in infrastructure, but also in people, developing skills and knowledge to help create and sustain sovereign capability.



CASE STUDY 3:

Creating the conditions for sovereign capability

To be an originator of new technological innovations and to advance Australian industry, Australia needs a robust pipeline across all the stages of technology readiness. NG Australia has been supporting this pipeline – at all levels – to promote Australian research and development success.

NG Australia has formed 65 Australian partnerships supporting institutions, STEM events, Government, SMEs and non-government organisations. Of these 65 partnerships, 39 are directly related to technology readiness.

Figure 4 – Technology Readiness Levels (TRL) definitions

TRL 1-4	Basic Research; Applied Research; Critical Function or Proof of Concept Established; Lab Testing/Validation of Alpha Prototype Component/Process
TRL 5-6	Laboratory Testing of Integrated/Semi-Integrated System; Prototype System Verified
TRL 7-9	Integrated Pilot System Demonstrated; System Incorporated in Commercial Design; System Proven and Ready for Full Commercial Deployment

Source: Defence Science and Technology Group

Early readiness – Research

Creating the conditions for technological innovation requires building and fostering talent throughout every stage of the lifecycle. This ‘talent pipeline’ starts at research institutes. NG Australia’s engagement with universities to research the latest technology reflects a commitment to long-term investment.

There is a considerable amount of competition for limited resources across a broad field of research careers. By building long-term relationships with the institutions, NG Australia offers a pathway for Australian researchers to reach into and build upon the deep talent pool of NG contacts in relevant US Government research organisations. It also offers the opportunity for partnerships with US universities that are undertaking research. This helps to enhance the career opportunities for researchers and to attract future technology leaders to the rapidly growing defence sector, allowing more technologies to originate in Australia.

Over the past three years, NG Australia has been involved in **18 research partnerships** in the early readiness phase. The engagements span five states and territories and include many of Australia's leading institutions. These engagements are diverse, from assisting institutions to attract talent by offering substantial individual prizes in STEM, to research projects for development of technologies on the latest platforms. These projects range from the latest in autonomous systems, Artificial Intelligence and Machine Learning, cyber security and next generation quantum computing to space systems and satellite technology.

Development pathway – Demonstration

At the research level, there is a considerable amount of competition for talent across different sectors. Moving out of the lab is challenging. In Australia, there is less of an established transition pathway from the lab to commercial-ready product. This step requires expertise in both the technology and industry. The key to success is the ability to take a concept and fine tune it into a product that can be developed within a broader platform of design and development. One example is the contracted development with the University of Queensland, Sustainable Space Launch, Launch Modelling & Simulation.

NG Australia is assisting researchers and aims to boost the opportunities for emerging talent. At present, there are **10 NG Australia projects** in this stage of the pipeline. These projects are in vital program areas, such as mission engineering, signals and communication defence, advanced sensor technology and 'low observables'. Projects in the demonstration phase are dispersed across Australia with four states and territories involved. These projects have a wide range of technology and skill requirements.

The most important factor of success is building long-term relationships between NG Australia and the university/government sector.

NG Australia offers more than funding for this research, although that is also an important enabler. It also offers decades of experience of defence technology, a global network of partnerships with technology providers, existing platforms to integrate innovative products and the focus and experience of success in the industry.

Product to market

NG Australia offers the opportunity for SMEs to develop solutions for current and future technology. NG Australia has **11 active or proposed programs** for SMEs in addition to **12 enterprise partners** in the Joint Air Battle Management System enterprise. These partnerships will develop next generation hardware and software ranging from technology for taking rockets into space, satellite communications, radar and sensor technology, advanced artificial intelligence through to advanced warfare simulators.

Some examples of NG Australia working with Australian SMEs to bring products to market include Silentium and passive radar systems, Daronmont and their work with complex high technology systems and Arciteca and their work on large data analytics.

What NG Australia offers is more than the direct opportunities SMEs gain from the mentorship provided, as well as experience in project delivery. This enables SMEs to be better prepared for the rigours required to deliver projects. NG Australia plays a key role in supporting companies to develop their products and processes to be 'Defence ready'.

Once these companies reach the standards required, they can be accepted as a reliable defence and aerospace partner. This opens up a range of new opportunities for these companies, not only with the ADF, but also across the entire network within the NG global supply chain and with other providers to Defence.



CASE STUDY 4:

Future sovereign communications network

NG Australia has a demonstrated history of, and a future commitment to, deep investment in software engineering in Australia, which supports capabilities, skills and business development. NG Australia is supporting the ADF through the delivery of nationally significant infrastructure, the Satellite Ground Station - East Facilities Project, which provides a foundation for state-of-the-art defence communications into the future.

The JP2008 program is a core component of the satellite communications with Australia's future autonomous vehicle fleet. The Kapooka Satellite Ground Station East (SGS-E) is the primary ground station for the Australian East Coast to anchor the satellite communication network. Combined with Satellite Ground Station West (SGS-W), it provides a range of communication capabilities, including critical intelligence services from operations in the Pacific and Indian Oceans.

The next phase includes the development and delivery of the Network Management System that will plan, activate, monitor and control all Australian Defence satellite operations. This includes the sustainment of facilities. Success of this phase involves deployment of new capability to deliver 21st Century systems engineering on the ground in Australia. JP2008 Phase 5B2 will have an Australian team of software engineers supported by a NG team in the US. NG Australia has already invested \$10 million in knowledge acquisition, and more software engineers will be needed as the project develops. Nationally, NG Australia has hired 64 additional engineers across 13 core engineering capability areas over the past 12 months.

A key outcome associated with the JP2008 program is the adaptation of NG's technology to meet Australia's local design requirements across a series of communication programs using an agile methodology. This means that Australia will receive a communication-secured software platform that is tailored to the needs of the ADF.

The development of a complete integrated software solution is complex. NG Australia believes that a partner who understands the defence sector and the ADF, and who can deliver solutions in Australia, is vital to the future of the ADF capability realisation.

NG Australia has a demonstrated history and a future commitment to making a deep investment in software engineering in Australia. This is because NG Australia recognises that creating 'centres of excellence' that enable integration across software capability will greatly reduce the risk of delivery on these long-term programs. It is this long-term commitment that is required for Australia's national security future, as communication software platforms and integrated solutions will be relied upon across land, sea, air and space to allow simultaneous output.

Future focused

NG Australia will continue to pursue a strategy of partnership between defence industry in Australia and the US. JP 2008 SGS-E and deployment of the first MQ-4C Triton uncrewed Aerial Vehicles are expected in country by 2023-24. The next phase of Australia's sovereign capabilities will focus on programs such as the future Air and Missile Defence Program.

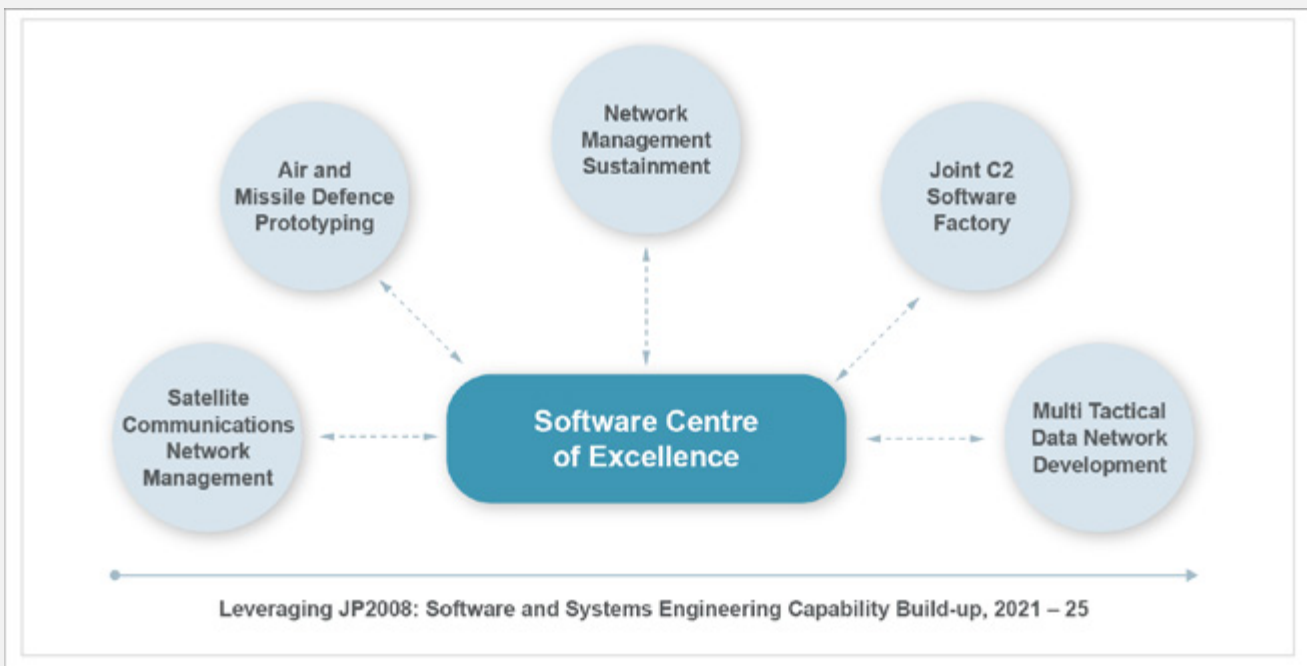
The AIR6500 Integrated Air Missile Defence Program is one of the most complex that Defence will deliver. Australia will require partners like NG Australia with a track record of delivery to build sovereign capability in complex programs that have inherent risk. NG Australia will partner with SMEs as a new architecture backbone is developed.

The ADF plans to link together sensors and capabilities into an integrated system. The system will allow detection, decision and response to future air and missile threats to Australia and any deployed forces.

NG Australia will continue to invest in Australia's sovereign capability. The Australian operations will draw on extensive expertise from NG US and research and development partnerships within Australia to aid the ADF to deliver an embedded software engineering solution in Australia.

These investments will be the start of a future-focused industry lasting for decades to come.

Figure 5 - Software and Systems Engineering Capability Build-up Leveraging off JP2008



Source: Northrop Grumman Australia



7. Beyond policy

As Australia's national security policies drive transformative policies for rapid technology uptake and industry capability, it has declared a critical need for strong and reliable partners, not just in the procurement of technology but also in the generation of war fighter capability in real time.

This report confirms and illustrates that NG Australia's rapidly growing contribution to Australia is multi-faceted. NG Australia is investing in growing future Australian industry and sovereign capabilities, with a focus on building a skilled workforce and providing access to global opportunities.

NG Australia's global connections makes it well placed to strengthen Australia's defence capability through emerging opportunities under the Australia, United Kingdom (UK) and US AUKUS trilateral security pact, building upon the foundation of the existing Strategic Update and Defence's Integrated Investment Program.

Looking forward, NG Australia plans to actively partner and support the realisation of:

- The AUKUS trilateral technology pact and the reported focus on cyber capabilities, artificial intelligence, quantum technologies, undersea warfare and, most prominently, nuclear submarine capabilities.
- Technology sharing, which has already begun with NG Australia's \$20 million investment in Parallax Labs in Canberra.¹ The labs support projects with complex systems and technologies to enable advanced simulations, automation and integration for critical mission systems. The labs will also facilitate the transfer of technology to Australia.

- The Australian Civil Space Strategy, which sets out priorities for this emerging sector developing in Australia including geo-positioning, navigation and timing; earth observation; and communications technologies and services.
- The development of sovereign capabilities in line with the Sovereign Industrial Capability Priorities that are identified by the Australian Government as essential for maintaining the ADF's combat edge.

This report shows that NG Australia is well positioned to be a strategic partner across these domains. NG Australia is being proactive with continued investment in Australia's skills and industry and, with the advent of AUKUS, now has the potential to accelerate the evolution of the ADF to meet the rising challenges of the global strategic environment.

Importantly, NG Australia indicates that its focus is not only on delivering the appropriate technology or new platform but also in leveraging a deep understanding of 'know how' and to 'know why' a capability is employed. That is, in delivering solutions, NG Australia has indicated that it is important to know both how a solution will integrate into the broader force and why it will integrate and improve existing complex systems going forward. It is this future focus which enables NG Australia to pioneer solutions able to stand the test of time and keep pace with the speed of the future threat.

Australia's strategic environment is becoming increasingly challenging, compounded by rapid developments in a range of new technologies. NG Australia, with its deep experience and global outlook, is committed to further contribute to Australia's mission, including the technological innovation and transfer opportunities into the future offered by arrangements under AUKUS and through other initiatives such as the QUAD.

¹ [Northrop Grumman Australia Opens State-of-the-Art Lab in Canberra | Northrop Grumman](#)



Appendices

Appendix A: KPMG-CGE model

Model data and theory

The wider economic contributions of NG Australia have been estimated using a CGE model of the Australian economy called KPMG-CGE. The main features of the KPMG-CGE database and theoretical structure are as follows.

- The key data input used by KPMG-CGE is an input–output table that quantifies the flow of goods and services between producers and various users (e.g., intermediate inputs to other producers, inputs to capital creators, households, governments and foreigners) and the flow associated with primary factor inputs (i.e., labour, capital, land and natural resources).
- Primary factors are distinguished by 117 types of capital (one type per industry), nine occupations, two types of land (primary and non-primary production land), natural resource endowments (one per industry), and owner-operator labour. There is a representative firm in each sector that produces only one commodity. Commodities are distinguished between those destined for export markets and those destined for domestic sales.
- Production technology is represented by nested CRESH functions (Hanoch, 1971)² allowing a high degree of flexibility in the parameterisation of substitution and technology parameters. Energy goods are treated separately to other intermediate goods and services in production and are complementary to primary factors.
- There is an infinitely-lived representative household agent that owns the major share of factors of production with foreigners owning the remainder; the representative household can either spend or save its income. Total household consumption is assumed to be a function of household disposable income and the average propensity to consume. In the long run, the average propensity to consume is endogenous and adjusts so that the ratio of net foreign liabilities to GDP stabilises. This mimics time-consistent behaviour by households and imposes a budget constraint on household behaviour in the long-run. Household consumption decisions by commodity are determined by a Stone-Geary utility function that distinguishes between subsistence (necessity) and discretionary (luxury) consumption (Stone, 1954).³
- The supply of labour is determined by a labour-leisure trade-off that allows workers in each occupation to respond to changes in after-tax wage rates, thereby determining the hours of work they offer to the labour market. The overall supply of labour is normalised on working-age population.
- KPMG-CGE includes detailed Commonwealth and State Government fiscal accounts, including the accumulation of public assets and liabilities; these are based on the Australian Bureau of Statistics' Government Finance Statistics.⁴
- Investment behaviour is industry specific and is positively related to the expected rate of return on capital. This rate considers company taxation and a variety of capital allowances, including the imputation system.
- Foreign asset and liability accumulation are explicitly modelled, as are the cross-border income flows they generate and that contribute to the evolution of the current account. Along with other foreign income flows, such as labour payments and unrequited transfers, KPMG-CGE considers primary and secondary income flows in Australia's current account; these are particularly important for Australia as they typically comprise the significant share of the balance on the current account.

² Hanoch, G. (1971), 'CRESH production functions', *Econometrica*, vol. 39, September, pp. 695–712.

³ Stone, R. (1954), 'Linear Expenditure Systems and demand analysis: an application to the pattern of British demand', *The Economic Journal*, vol. LXIV, pp. 511–27.

⁴ Australian Bureau of Statistics (2019). *Government Finance Statistics, Australia, 2017-18*, Cat. no. 5512.0, Canberra, April.

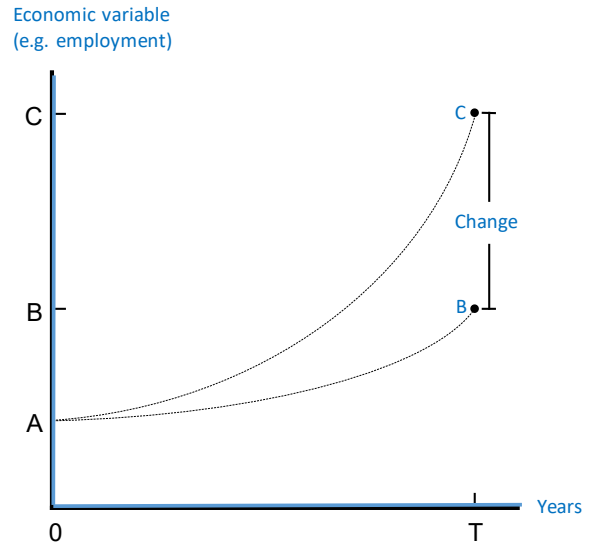
Model outputs

To generate results, the model is run twice for the project being assessed. First, a baseline simulation is run to capture a snapshot of the economy in the absence of the NG activity. Second, a counterfactual simulation is run to capture a snapshot of the economy with the NG activity.

The economic contribution of NG in Australia is measured by the difference in the values of economic variables between the baseline and counterfactual scenarios. This process is illustrated in Figure 6.

Considering employment as a variable of interest, the current level of employment in the initial database is at point A. In running the baseline scenario, the model will generate a forecast of employment before the implementation of NG activity – this is at point B. Then, in running the counterfactual analysis, the NG activity is implemented, and the model recalculates the value of employment – this is now at point C. The employment impact of the NG activity is the employment difference between the counterfactual and baseline result (C-B). This calculation is repeated for all economic variables in the model.

Figure 6: Illustration of how simulation results are to be interpreted





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