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Manus Island and the Lombrum Naval Base: Five Options for Australia's Geostrategic Gateway

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An Introduction from the Lead Investigator

Manus Island is the geostrategic gateway to the South Pacific. It is ideally positioned to support offensive, defensive or humanitarian operations throughout the region. Over the years, Manus Island's geostrategic value has not been lost on regional players, with Britain, Germany, Japan, Australia and the United States having all garrisoned forces there. More recently, there have been reports that the island has caught China's eye.

What are Australia's strategic options for Manus Island and the Lombrum Naval Base? This paper does not seek to argue for one option over another. Instead, its objective is to be a discussion paper that maps out the different options and explains their benefits, limitations and financial costs. It hopes to provoke thought, discussion and argument on the future of Manus Island specifically, and Australia's geopolitical goals and vision for the wider South Pacific more generally.

It is hoped that this will help sharpen the discussion and strategic thought.

I would like to thank our research assistants Patrick Gulliver, Divyani Chhibbar, Kausalyaa Chandra, Nikki Lee, Janette Nalbandian, Vinh Bai Ly, Chris Mansell, Katrina Petsas, Ben McManus and Phyllis Lo. These students took part in Macquarie University's ground-breaking PACE (Professional and Community Engagement) program wherein students gain practical research experience. They all did a tremendous job.

I would also like to personally thank the many officers and public servants who sacrificed their time to speak with our research team. I would also like to thank the champions of the research project at the Sea Power Centre, namely Captain Sean Andrews, Commander Richard Adams, Commander Alastair Cooper, and Lieutenant Will Singer. Their support and guidance have been integral to the project's success.

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Introduction

When future generations look back at Australia's current geopolitical moment, and judge the national response, there are several features they will be compelled to note. In discourse, our political leaders have aimed to shake the nation from its complacency by evoking the strategic dangers of the 1930s and 40s.[1] In raw capability terms, the Royal Australian Navy's current expansion will result in the total size of the fleet exceeding 50 vessels for the first time in decades.

But few things will evoke the moment better than the fear of foreign military bases in our near abroad, and the bold plan – as yet tentatively pursued – to reinaugurate one of our own. For Australia, to open an overseas base is a surpassingly rare event. World War II saw Australia open a slew of overseas bases and depots; few outlasted the conflict, and all except rare administrative posts were closed by the mid-1970s.[2] As has proven so often the case in naval basing history, the rationale of well-chosen geographical advantages and shared history have dictated not a new location, but the reviving of an historical one[3]: Lombrum Naval Base on Manus Island.[4]

Over recent decades, Manus Island's longstanding role as a naval base has received far less attention than its use for the detention and processing of asylum seekers. During its heyday in World War II, the combined naval and air base hosted 37,000 personnel, anchorages for more than 260 combatant units, and repair facilities matching those of Pearl Harbor.[5] Seven decades later HMPNGS *Tarangau* had become significantly humbler, primarily consisting of a wharf for PNG's three ageing Pacific-class patrol boats gifted by the Australian Government.

In July 2018, however, the strategic value of Manus Island once again began to be recognised when Australian Prime Minister Malcolm Turnbull and his Papua New Guinean counterpart Peter O'Neill discussed the base's redevelopment.[6] This was followed by a scoping study by Australian officials the following month.[7] And, by November, the United States' Vice President Mike Pence announced his nation's involvement and support for the initiative, thrusting the future of the naval base at Lombrum into the forefront of strategic discussions and debate.[8]

The redevelopment of the naval base at Lombrum was seen as a key feature of the 'Pacific Step-Up', a package of diplomatic, trade, infrastructure, aid and defence initiatives aiming to buttress Australia's status as the security partner of choice for the Pacific Islands,[9] as well as a response to a series of media reports that the Chinese Government was seeking to establish a naval base in the region.[10]

From such a momentous announcement, the renaissance of this once major naval base has been gradual, to say the least. In June 2020, the Australian Strategic Policy Institute's Peter Jennings noted that: "This was in many ways the centrepiece of the Prime Minister's Pacific Step-Up, and it's frankly a little disappointing we have not been able to make much faster progress than we have."[11]

The United States appears to be urging Australia to take the lead, as has been the norm historically in relation to security and defence issues in the Melanesian Arc.[12] In May 2021, acting US ambassador Mike Goldman repeated that his country had high expectations for the eventual scale and capabilities of the base – "I think we would like to make it as ambitious as possible in co-operation with Australia and Papua New Guinea" – without indicating a willingness to fund the redevelopment or negotiate with PNG directly.[13]

Therefore, a considerable gap exists in the public discourse between the stated ambitions of the United States and Australia, on the one hand, and the current state of the base on Manus Island, on the other. Accordingly, this paper reviews possible strategic futures for the Lombrum Naval Base ranging from the minimal case of developing the site for the repair and maintenance of the Pacific patrol boats program, to a maximal case that approximates the capabilities of the US base on Guam. Indeed, Guam and Manus could work together as two links in a chain that stretches across the leading edge of the South Pacific. As will be discussed, each option possesses its own set of advantages, opportunities, costs and challenges. The paper begins with an historical overview of Manus Province and its relationship with Australian defence policy over the past two centuries. This section provides context for the current set of proposals and underscores the enduring strategic importance of the deep-water port on the northern edge of Australia's traditional area of primary strategic concern. Next, the paper discusses the five broad strategic futures of Manus Province and their potential place within Australia's maritime defence policy:

- Pacific Slip
- Mothballed Launch Pad
- Strategic Observation Post
- Forward Operating Base
- Geostrategic Strongpoint.

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This paper is the accumulation of more than 18 months of research. It draws upon an extensive appraisal of publicly available materials, internal Department of Defence reports, and discussions with Australian and international officers, academics and other observers. Most of these discussions were conducted off the record to facilitate the free exchange of ideas and opinions. Despite learning a great deal from our conversations, we would like to stress that all arguments, opinions and proposals presented below are ours alone.

HMAS Choules at Manus Island HMPNGS Tarangau, Lombrum Naval Base. Photographer: SGT W. Guthrie

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The History and Strategic Importance of Manus Island

"The Pacific Islands are as necessary to Australia as water to a city. If they were in the hands of a superior power, there would be no peace for Australia."

Prime Minister Billy Hughes, 1919.[14]

"We would view with great concern the establishment of any foreign military bases in those Pacific Island countries and neighbours of ours."

Prime Minister Malcolm Turnbull, 2018. [15]

The Admiralty Islands, an archipelago of 18 islands to the north of Papua New Guinea, are thought to have been settled at least 13,000 years ago.[16] The first recorded European sighting of Manus – the largest of the Admiralty Islands – was by Spanish explorer Alvaro de Saavedra on board the *Florida* on 15 August 1528.[17]

Between 1884 and 1914, the Admiralty Islands were administered as a German colony. Needless to say, an Imperial German foothold so close to the Australian mainland caused a great deal of security anxiety within the country and the moment that war was declared against Germany, on 4 August 1914, plans were set in motion to capture the territories. A mere two weeks later, on 19 August, a task group sailed from Sydney with orders to capture German New Guinea. By end of September, after having faced little resistance, the Australian and New Zealand expeditionary force had achieved their goals. After the war, the islands were governed by the Commonwealth of Australia under a League of Nations mandate.

In 1919, Admiral John Jellicoe was tasked with advising the British Admiralty on the future imperial naval planning in the Western Pacific. On his tour of the region, Jellicoe immediately recognised the strategic importance of Manus Island: located on the northern edge of the South Pacific, it could act as either a defensive asset or an offensive launching pad. In British hands, it could frustrate any attempt by a great power to invade Papua New Guinea and the South Pacific, which by extension protected Australia and New Zealand. Offensively, it could provide a launch pad to project naval power into South East Asia and through the Pacific. Jellicoe designated it as 'Harbour "A"', a prospective secret wartime base for a future concentrated Far East Fleet.[18]

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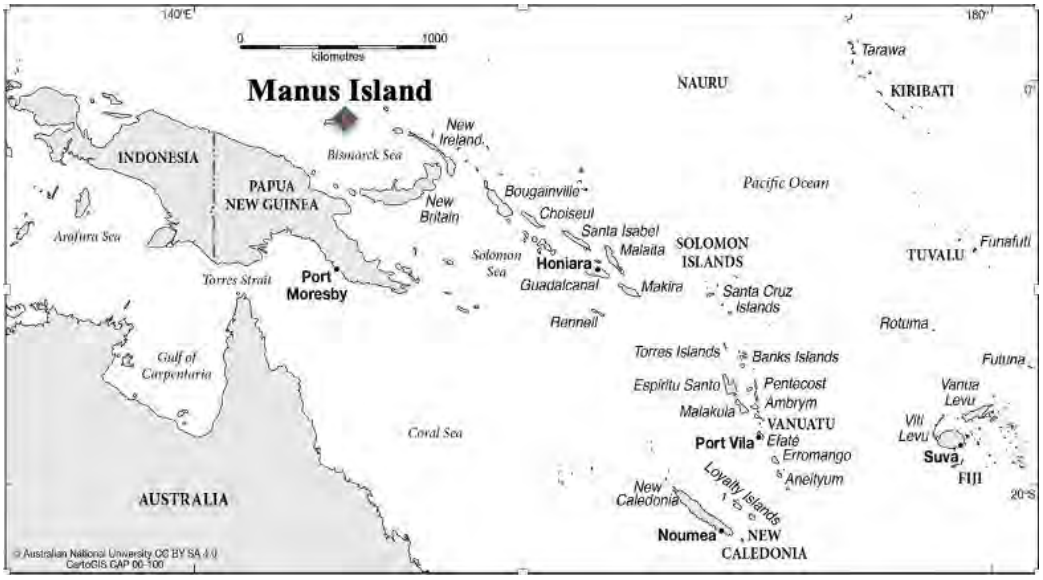
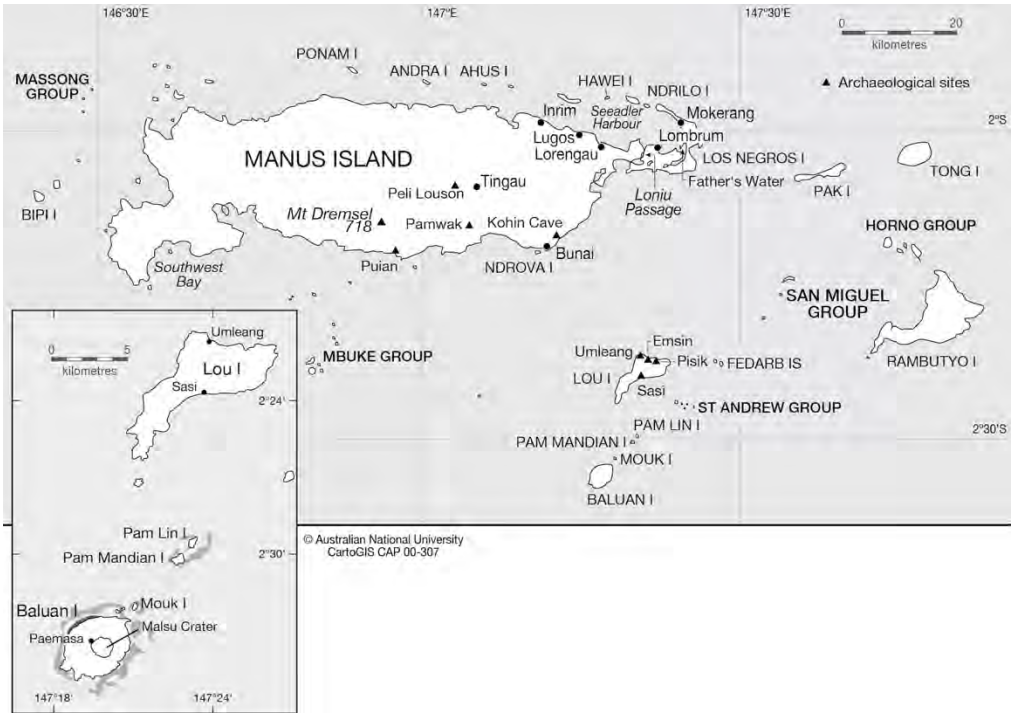
Map 1: Manus Island and the Melanesian Arc



Source: Australian National University, CartoGIS Services

Map 2: Manus Island



Source: Australian National University, CartoGIS Services

On 7 April 1942, Japanese troops landed on Manus and occupied – but did not heavily fortify – the island. An airfield was constructed at Momote on Los Negros Island, but little effort was made to exploit Seeadler Harbour with its more than 100 square miles of deep-water anchorage.[19]

In 1944, the Japanese forces occupying the islands were defeated by Allied forces.[20] Work to extend the existing airfield, develop another and build shore installations began immediately, with the RAN contributing with a survey of the main anchorage.[21] By September 1944, Manus Island was the centre of a naval and air base complex manned by 37,000 personnel. Seeadler Harbour had designated anchorages for more than 260 combatant units. The repair facilities matched those of Pearl Harbor and included a floating dock with a capacity of 100,000 tons, big enough to take the largest aircraft carrier or battleship. Over five months, the United States spent US$238 million on the project. The RAN and BPF (British Pacific Fleet) continued to use it as a staging post between Australia and Japan.[22]

After the war, an Australian base on Manus was formally established in 1950 at Lombrum, initially commissioned as HMAS Seeadler, but soon renamed Tarangau to avoid German connotations. Over the next decade, oil fuel storages, a wharf and radio station were built, and the harbour proved a useful stopping point for RAN units on the way to the Far East Strategic Reserve, as well as the base for the slowly developing Papua New Guinea Division of the RAN.[23] With independence in 1975, establishment of the Papua New Guinea Defence Force saw the base transferred to PNG control. Despite chronic shortages of money and materiel in the decades since, Lombrum Naval Base continues to be key to the PNGDF's maritime operations.[24]

The Strategic Value of Manus – Australia

There are three reasons why Australia continues to be interested in Manus. First, the islands are proximate territory through which a conventional military attack would most likely originate. As Stephen Walt confirms, "because the ability to project power declines with distance, states that are nearby pose a greater threat than those that are far away".[25] If a hostile great power possessed a forward operating military base, they would be more capable of undertaking a conventional attack upon the Australian mainland with lower risks, fewer capabilities and sustain the operations longer than if they were forced to launch the assault from more distant areas.[26] Since Europeans first settled Australia it has been an enduring security anxiety that a hostile great power may acquire a foothold within the Melanesia Arc – which stretches from East Timor to Papua New Guinea, Solomon Islands, Vanuatu, New Caledonia and Fiji – flanking much of the north and north-east of the continent.

The geostrategic value Australia has placed on Manus Island has ebbed and flowed with the perceived threat from a hostile great power to Australia's immediate region. During the 19th century, the pervading fear within Australia was that the European scramble for colonies would see new and existing European powers claiming colonies within the South Pacific.[27] Indeed, the frustration the Australasian colonies felt over British indifference towards their concerns about Germany's expansion in the Pacific helped drive the movement towards federation.[28]

Second, Australia's sea lines of communication (SLOC) to both Asia and North America pass through the area. The strategic gravity of these lines was underlined in 1942 when Imperial Japan decided against the invasion of Australia, but instead occupied New Caledonia, Fiji and Samoa in order to establish air and submarine bases from which to disrupt supply routes between the United States and Australia's east coast. It was the Battle of Midway that put an end to those plans.[29]

In credible scenarios where SLOC become problematic in the South China Sea and/or Straits of Malacca, alternative routes through Indonesia (Sunda Strait, Lombok Strait) or ultimately around Australia and via the Pacific Islands would become relatively more attractive. Accordingly, Lombrum and Manus would take on a much greater strategic significance during conflict.

Finally, an Australian defence presence at Manus de-facto denies the same location to other regional powers. Chinese interest in the redevelopment of four PNG ports at Wewak, Kikori, Vanimo and Manus Island[30] have been cited in media reports, as well as speculation about the Solomon Islands and Vanuatu.[31]

ANU Professor Rory Medcalf has described a "base race" across the Indo-Pacific, though noting the race began much earlier for some than others. According to Medcalf, "Much of the analysis of China's port and base projects available in the public domain remains fairly speculative, though concerns being aired by various governments are presumably informed by sensitive intelligence and diplomatic reports." These include reclamation and defence installations in the South China Sea and growing evidence of preparations for a Chinese base at Ream, Cambodia. Civilian deep-water port facilities with the potential for military use include Djibouti and potentially Gwadar in Pakistan, Hambantota and perhaps Colombo in Sri Lanka, Kyaukpyu in Myanmar, and several locations such as Chittagong or Cox's Bazar in Bangladesh, East Timor, Vanuatu and the Solomon Islands among others. Despite its seemingly out-of-the-way location, the South Pacific has since 2015 been officially declared by China as a branch line of the Belt and Road.[32]

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The Strategic Value of Manus – United States

The United States is facing very real limitations on new basing locations in the Indo-Pacific which are strategically useful, outside the perimeter of China's conventional strike capabilities, and politically welcomed by the host nation.[33] While some have argued that the US military posture in the Indo-Pacific region is reasonably well aligned with American interests and strategy already, and further bases come with more implicit and explicit obligations than benefits,[34] it is also clear Washington has more than a passing interest in Manus. Besides the redevelopment of Manus, the United States is exploring an offer from Palau of the Federated States of Micronesia to build joint-use facilities – bases, ports and airfields, and potentially even land-based missile units – and then station US forces there. Some 400nm closer to the South China Sea than Guam, it is also within the conventional strike range of China.[35] Manus would tick the boxes for the United States – especially if Australia does the heavy lifting diplomatically.

The Strategic Value of Manus – PNG

Lombrum is the home port of the PNG Navy's pacific patrol boats. Redevelopment of the base has significant strategic benefit for PNG. While PNG political reaction has been mixed, particularly at the provincial level, the PNG Defence Force has been supportive. The head of PNGDF Major General Gilbert Toropo said in 2021, "redevelopment and rehabilitation of Lombrum Naval Base will really set the foundation for our effective maritime patrols. In the sense that when we don't have an effective and strong security force element, then we are vulnerable to that country's (China's) presence." [36]Toropo's vision is in lockstep with that of Australia and the United States.

The Case against a Base

While the strategic benefits of a base at Manus for Australia, the United States and Papua New Guinea are significant, it is worth considering arguments against a base. In one sense, the desire to establish overseas land bases can be reflective of a continental mindset. It is an accusation made against China's island building in the South China Sea;[37] that is, trying to achieve sea control through fortresses, rather than with the skillful use of naval vessels. There is an element of truth to this position. The RAN has maintained an effective presence through Asia and the Pacific without a forward base. However, as the US Navy can attest, although forward operating bases are not essential to projecting sea power, they certainly help.

Equally, a 'blue water navy' such as Australia's is abundantly capable of underway replenishment with its own vessels, or, as the RAN points out, with any of the "more than thirty navies with which Australian warships can safely conduct underway replenishment with little or no notice".[38] It continues: "The availability of underway replenishment ships and the ability to resupply at sea enables warships to remain on station for prolonged periods or at a greater distance from shore-based support."[39] It must be added, however, that this capability is complex rather than linear; that is, the ability to replenish underway changes under different scenarios. Under some scenarios, underway replenishment would benefit greatly from the option of deploying from a forward base, or the supply ship shuttling between the forward base and the fleet at sea.

Other worthwhile proposals have been made in lieu of a base. For example, a purpose-designed ship that could be located at Manus and provide fuel, storage and treatment for oily and brown-water discharge, stores and provisions, munitions, workshops and medical facilities. These proposals, however, are a base under a different name, as ships and submarines would berth alongside such a vessel.[40] As demands on such a ship grew, they would quickly spill out onto the land.

The Current State of the Base

As a functioning PNGDF patrol boat base, HMPNGS Tarangau, and former site of the Manus Regional Processing Centre, the Lombrum site contains existing infrastructure and utilities that can be utilised to support new capabilities under consideration (see Table 1).

Table 1: Manus Island's Current Infrastructure	
Power	1 x 26.9MW Cummins KTA50-G3 at Lombrum Power Station
	4 x 2MW containerised gensets
Water	9,000L rainwater tanks on site
	Reverse Osmosis Water Treatment Plant capable of providing 1100L/per hour
Fuel	550,000L diesel fuel farm on site
Sewage	Sewage treatment facilities to support at least 500 people on site
Amenities	Communications Centre
	Perimeter Fence and Guard House
	Sports Field
	Medical Centre
	Warehouse and Storage facilities

Accommodation	Two storey self-contained accommodation for up to 432 detention facility staff
	Three storey accommodation for up to 210 detention facility staff
	PNGDF Officer/Senior sailor and Enlisted sailor housing
Harbour Infrastructure	125m x 10m Live Ordnance Departure Area [LODA] wharf
	80m x 10m Nawai Wharf
	Harbour depth between 7m and 14m
Momote Airport	Runway length 2080m

Over the past decade, periodic calls have been made for the Australian Government to redevelop Manus.[41] In 2018, Australia and Papua New Guinea announced that they would undertake an upgrade of the naval base at Lombrum, starting with $5 million to build the since-completed 125m-long LODA (Live Ordnance Departure Area) wharf to accommodate four new Guardian-class patrol boats that have been gifted by Australian Government (one of which is already in service).[42] The three remaining Pacific-class boats will presumably be moved back to the smaller Nawaii Wharf.

The Australian Government has also announced two initial tenders. Project 224 called the 'Lombrum Infrastructure Project' is an Australian-funded upgrade to the facilities at Lombrum Naval Base that commenced in November 2019 and was completed in June 2020. Project 224 included: a) demolition works, b) medical facility, c) guard house and d) perimeter fence. Project 225 named the 'Lombrum Infrastructure Upgrade' is the follow-on program to P224. P225, launched in September 2020 with an estimated date of completion in November 2022, involves a more significant refurbishment and rebuild of the facilities at Lombrum. It is estimated to cost $130–$175 million. Project 225 includes: a) setup of life support and marine UXO clearance and shipwreck salvage, b) construction-enabling works and site-wide civil works, c) water and wastewater sewerage infrastructure upgrade, d) fuel, power generation and distribution infrastructure upgrade, e) base ICT infrastructure, f) PNGDF headquarters, g) ammunition storage facility (magazine), h) officer/senior sailor and junior sailors permanent accommodation, i) all ranks transit accommodation and combined mess and recreational facility, j) LCT ramp hardstand and finger jetty upgrade, k) community chapel and community hall, l) ablution blocks, m) small boat ramp, n) temporary barge-landing ramp and o) Guardian-class patrol boat refuelling works.[43]

The key feature of these two tenders will be infrastructure to allow the RAN's LHDs to deliver troops and equipment onshore via LLCs more easily with the construction of the LCT Ramp Hardstand.

These works will allow the PNGN to effectively operate their new Guardian-class boats and help facilitate port visits by the RAN; however, they remain minimal. They do not fully exploit Manus Island's full geostrategic value. The next section sketches five alternative possible futures for the island, namely as a:

- Pacific Slip
- Mothballed Launch Pad
- Strategic Observation Post
- Forward Operating Base
- Geostrategic Strongpoint.

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Option 1: A Maintenance Hub for Pacific Patrol Boats

The first possible future for the naval base at Lombrum is to develop it into a maintenance hub for the 21 Guardian-class patrol boats that are being built and progressively gifted by Australia to various Pacific nations. The maintenance of the Guardian-class patrol boats will be more expensive and complex than the Pacific-class patrol boats they replace. It is expected that they will require an intermediate docking every two years and a refit every five years, at an average cost of $4–5 million per annum each. The recipient countries have neither the resources nor capabilities to perform such maintenance. As such, the boat's shipbuilder, Austal, currently holds the contract to provide maintenance for all the boats at its facility in Cairns until 2023. This contract is worth approximately $24 million.[44] A condition of the 2024 tender could be that maintenance of the boats is relocated to Lombrum.

There are several arguments for why the maintenance of these boats should be relocated from Cairns to Manus Island. First, Manus will be the home port for the highest number of Guardian-class patrol boats. Papua New Guinea is intended to be the recipient of four patrol boats, having already taken delivery of HMPNGDS *Ted Diro* in 2018. This is twice as many boats as the next nation. If, as expected, they remain home-ported at Lombrum, it represents a critical mass and logical location for maintenance facilities. Second, there are political benefits in having the boats sustained within the South Pacific. The need to return to Australia for even routine maintenance reinforces the notion that they remain Australia's boats – on loan. Despite Australia continuing to fund the program and Austral (or future tender holder) supplying the expertise, the optics of moving the boats between South Pacific nations rather than back to Australia would surely be welcomed by our partners.

Table 2: Guardian-class by Recipient Nation	
Papua New Guinea	4
Timor Leste	2
Tonga	2
Solomon Islands	2
Fiji	2
Federated States of Micronesia	2
Vanuatu	1
Tuvalu	1
Samoa	1
Palau	1
Kiribati	1
Cook Islands	1
Marshall Islands	1

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Requirements to Realise this Strategic Option

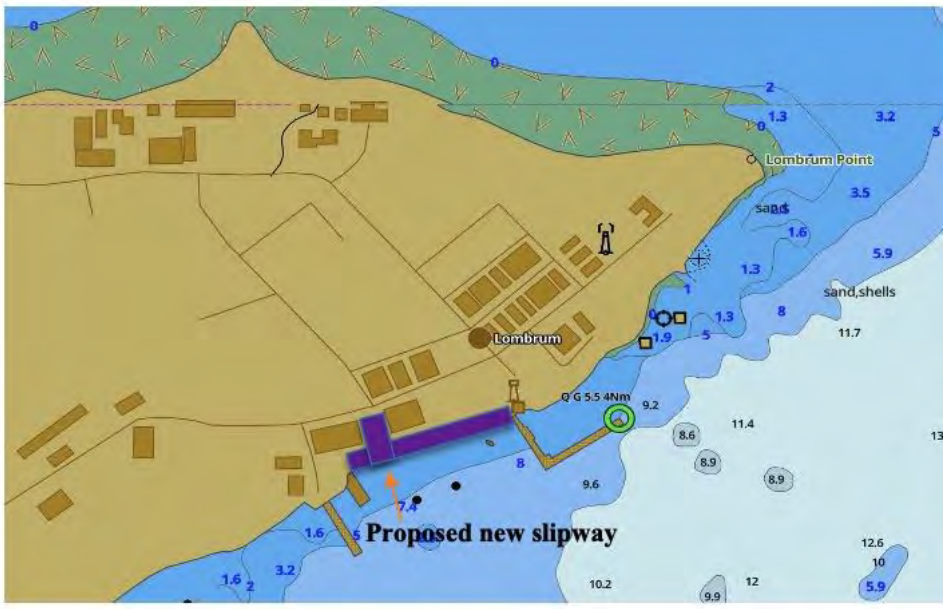
Achieving this option would require three main additions to Lombrum: a slipway, a hoist and new workshop facilities.

Slipway

Lombrum would require the construction of a rail slipway and the installation of a mobile boat hoist to lift vessels out of the water for transfer to hard stand or maintenance facilities.[45] This slipway would need the construction of a recess flanked by new sections of seawall located between the base of the new LODA wharf and the Nawaii wharf. This will involve land reclamation behind the new seawall (below), which could be achieved by dredging a channel into the slip, dredging and excavating the slip recess itself, and the adjacent area.

Wharf space would be sufficient to berth the full complement of PNGDF ships and more than one or two others; it is envisaged that boats under repair would be moved to hardstand and others waiting to be slipped remain at anchor.

Map 3: Bathymetric map of Lombrum



Source: gpsnauticalcharts

Hoist

Maintenance operations could be supported by the acquisition of one 220-ton mobile boat hoist and a 200-ton mobile boat trailer. The mobile boat hoist allows for the dry-docking and transfer of the 162-ton Guardian class from the sea to concrete hardstands, providing the same capability as expensive and permanent dry-docks or patent slip railways. This reflects a scaled-down equivalent of the 1120-ton mobile boat hoist at BSE Cairns. The mobile boat trailer allows for movement of Guardian-class vessels from the mobile boat hoist to hardstands and shore-based maintenance facilities.

Warehouse and workshop facilities at Lombrum would need to be expanded to provide proper maintenance to the patrol boat fleet. Existing infrastructure includes World War II-era concrete hardstands and Quonset workshops. Half of the Quonset structures were replaced with modern workshops to service the incoming PNGDF Guardian fleet in 2017;[46] the remainder will need to be upgraded to this standard to provide maintenance to the entire Guardian-class fleet.

The estimated total cost Option 1 is **$26.55 million** (see Appendix 1).

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Option 2: A Mothballed Launch Pad

The 'mothballed launch pad' would build sufficient infrastructure on Manus Island so that it could be used at short notice for the full spectrum of operations. In short, only the infrastructure and capabilities that cannot be deployed on short notice would be built in-situ, with the remainder being deployed when and as required. In times of crisis or emergency, the ADF could transform the mothballed base into a military 'tent city' that is built for purpose. It could be a secure and reliable location for the ADF to use on short notice if called upon to respond to natural disasters, search and rescue, humanitarian disasters, offshore peacekeeping and stabilisation, or high-intensity warfare.

The main advantages of this option are flexibility and cost. Permanent buildings will not be erected where non-permanent transportable equipment and infrastructure could suffice in the future. Furthermore, when a task is necessary, only the capabilities that are required to fulfil that specific task will be deployed and then only until the completion of the task. The launch pad will create an extra line of operations from which the ADF will be able to respond in a fast and efficient manner (as compared to operating from bases located in Australia).

Unlike the other options discussed in this report, the mothballed launch pad will not result in an increase in ADF personnel permanently assigned to Manus Island, and this will not increase Australia's political and strategic 'presence' at the gateway to the South Pacific.

Requirements to Realise this Strategic Option

Existing Port Facilities
The current wharf facilities have insufficient sea-floor clearance and wharf length for RAN vessels greater than patrol boats. Additionally, with the PNGDF ships currently berthed there, there is not sufficient wharf space for additional RAN ships.

Extensive wharf facilities and dredging, however, are not necessary to accommodate a temporary surge in RAN vessels. During World War II, for example, more than 260 combatant units were accommodated at designated anchorages in Seeadler Harbour. Similarly, RAN ships could safely remain at anchor. Under this option, it is conceivable that refuelling could be undertaken by a commercially purchased fuel barge. Alternatively, a purpose-designed support ship could provide fuel, storage and treatment for oily and brown-water discharge, stores and provisions, munitions, workshops and medical facilities, and would be less vulnerable than a base.[47]

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Runway Extension

The major works under this proposal would be to Momote Airport. The single airstrip at Momote Airport is currently 2,080 metres in length, having been extended from 1,870 metres in 2016. The current runway is sufficient for the RAAF to surge in personnel and materiel with the C-17A Globemaster, which can operate from unsurfaced runways as short as 1,066 metres.[48] But, for maritime surveillance, it remains too short for the P-8A Poseidon, which needs a strip 2,850 metres long.[49] And in terms of projecting air power more generally, it is also too short to accommodate the RAAF's F-35A Lightning II ("A minimum runway length of 2,500 metres is required to safely operate"[50]). Under this option, the runway would need to be expanded 40 metres in width and 500 metres in length to accommodate these aircraft.[51]

With the existing layout of the Momote airstrip, the most feasible option would be to extend the runway northward. The airstrip can only be extended ~170m with the remaining land area before reaching the coast. Therefore, dredging and land reclaiming would be needed for the remaining ~770 metres of the runway (see Figure 1). This length includes the remaining runway of 680 x 45m wide (including a stop way of 60 x 45m), as well as a runway end safety area (RESA) of 90 x 90m.[52]

Figure 1: Momote Runway Extension

The second phase of the runway extension is the construction of a runway and airfield infrastructure on the reclaimed land.

This construction project would involve:

- an 850-metre extension of the existing runway, including a new stop way at the north end (60 x 45m wide), with 75mm asphalt surfacing
- new 7.5-metre-wide runway shoulders
- new runway end safety area (RESA) at the north end (90 x 90m wide)
- aircraft pavement line markings
- installation of High Intensity Approach Lighting (HIAL)
- installation of an Instrument Landing System (ILS).

An obstacle to the runway extension is an access road that runs along the coastline. This is not a high-traffic area and can possibly remain in use, cutting across the runway and overseen by security.[53]

Fuel

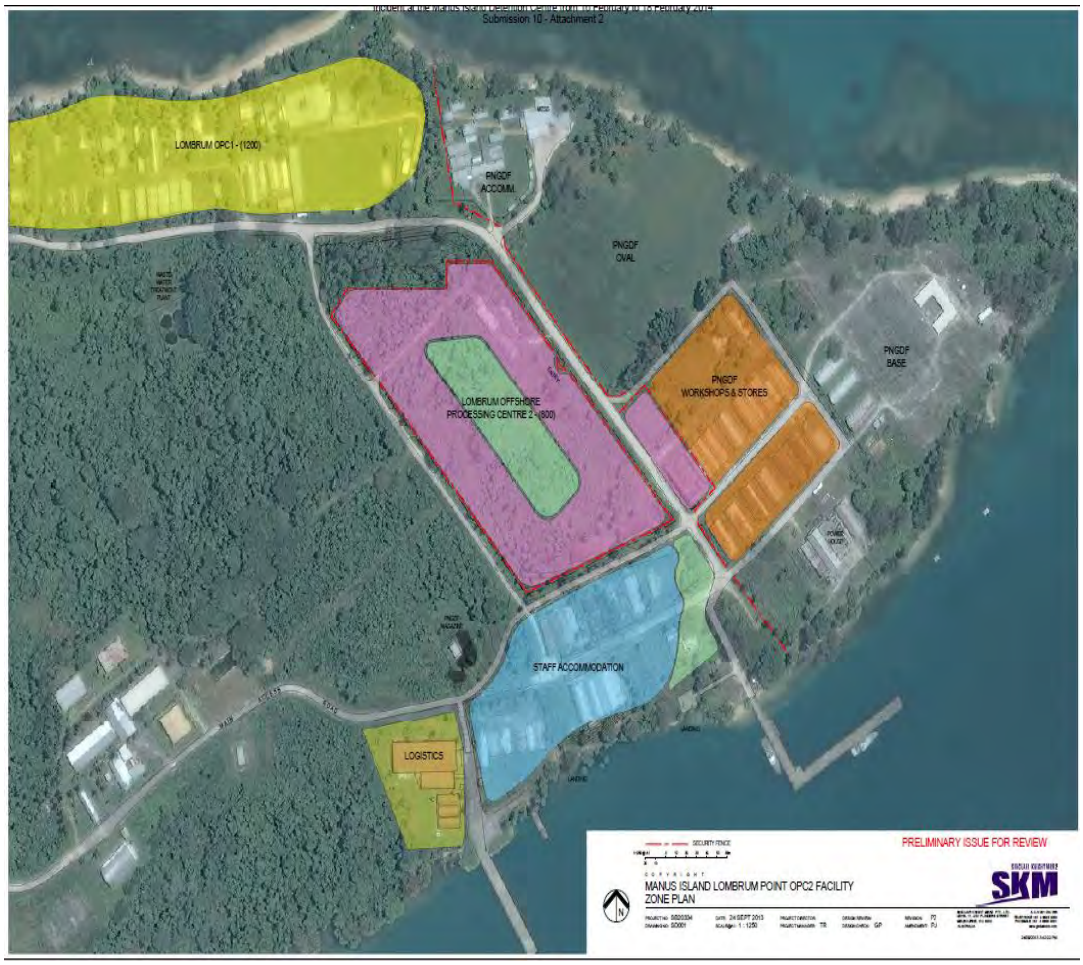
The existing 550,000-litre diesel tanks at Lombrum are insufficient for sustaining a substantial number of RAN vessels Under this option, the tanks could be decommissioned. Instead the two ADF-10 fuel tanks could be upgraded with a total capacity of 3.5–4 million litres of fuel, with pumps and pipes for feeding fuel to vessels. This line also includes the supplying and installation of any equipment and operating systems that are necessary to attain full functionality for the facility. In addition, a new separate fuel storage facility (fuel farm) would likely be required to adequately supply the aircraft at Momote. Costs include demolition, earthworks, pipelines, as well as installation of in-ground infrastructure including fuel tanks to support a ~250,000L aviation fuel capacity.

Power

The upgrade of Momote Airport in 2016 as part of the Civil Aviation Development and Investment Program included an upgrade to the power supply and electrical reticulation.[54] A further upgrade would be required for this proposal, in order to meet the power requirements for the new military airport infrastructure. This would involve the installation of a high voltage power supply, including drilling, trenching, excavation, cables and other equipment, as well as site-wide electrical work.[55]

The Lombrum Naval Base previously facilitated Australia's offshore processing detention centre for refugees. These centres, the Lombrum Offshore Processing Centre 1 and Centre 2, can be renovated and converted into living accommodation. Furthermore, the staff accommodation can be used as living quarters, and by using the greenfield area in the base to set up tents as living accommodation. With this type of redevelopment, the staff accommodation and the 'tents' could quickly accommodate up to 4,000 ADF personnel.

Figure 2: Location of Existing Accommodation



The estimated total cost Option 2 is **$414 million** (see Appendix 2).

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Option 3: A Strategic Observation Post

Warning times have always been critical to the ADF's ability to successfully deter and, potentially, respond to threats. Australia's strategic edge has long rested upon the superior training of its members and the quality of its technology to offset the challenges posed by distance and the opponent's likely advantages. This only holds, however, if the ADF has sufficient warning time to position its defensive assets in correct place, at the right time.[56]

Australia's regional maritime environment is becoming increasingly contested. In terms of share numbers, China now operates the world's largest navy and, over the past decade, other regional powers have invested heavily in maritime capabilities. Adding to this difficult environment, nations have been working on developing, or procuring, hypersonic weapons, long-range ballistic missiles and combat drones. These fast long-range weapons will decrease Australia's warning times. It is increasingly important to Australia's future maritime security that it be able to track maritime activity as far from its shores as possible.

Manus could potentially be used for forward surveillance, greatly extending Australia's ability to monitor the region and peer into South East and East Asia. Under this option, the air base could be used to base ADF piloted (e.g. P-8A Poseidon, E-7A Wedgetail) and unpiloted (e.g. MQ-4C Triton) maritime surveillance aircraft. A more ambitious course (Option 3.2) would be to build a Jindalee Operational Radar Network (JORN) transmitter and receiver on the island. Although potentially vulnerable, it would allow Australia to monitor surface and air movement deep into South East Asia.

Australian Piloted and Unpiloted Surveillance Aircraft

The Strategic Observation Post proposal envisages developing Momote Airport into a dual civilian–military airfield. Under this model, the airport could be upgraded to accommodate the Royal Australian Air Force's MQ-4C Triton and P-8A Poseidon surveillance aircraft. It is unlikely that the aircraft would be permanently based on Manus Island; rather, Momote Airport could serve to greatly extend Australia's observational reach through the Indo-Pacific region.

Operating surveillance aircraft from Manus would require much of the same work envisaged under the 'Mothballed Launch Pad' option (e.g. extending the runway's length), along with a few additional requirements, such as strengthening of security infrastructure at Momote Airport to meet the requirements of the ADF and accommodating ~50 personnel.

These ADF personnel would include members (and their families) who have been posted to the island, such as maintenance and repair crews and UAV technicians, as well as short-term visitors (e.g. flight crews).

Although the Tritons would most likely continue to be piloted from RAAF Edinburgh in the northern suburbs of Adelaide, South Australia, they could be launched and recovered from Manus (on a rotational basis) before returning to Australia for deeper maintenance and servicing.

Requirements to Realise this Strategic Option

The focus of this option would be on Momote Airport. It would include some of the same redevelopments as Option 2. For example, the fuel farm would likely be similar, except that under Option 3.1 it would be filled and frequently used by RAAF aircraft. In addition, however, the airport would have additional developments that correspond with its heavier use.

Momote Airport
The runway upgrade would be similar to those in the previous option. In addition to the runway extension, however, this strategic option proposes the upgrade and construction of infrastructure to comply with and accommodate the requirements of the RAAF MQ-4C Triton and P-8A Poseidon surveillance aircraft. These works would include:

- A new apron and taxiway proposed to be constructed to the north-east of the airstrip. The apron, accommodating up to six aircraft, would serve as a parking, refuelling and ordnance loading apron. The apron will incorporate a fuel hydrant line for refuelling the aircraft in the parking bays.[57] Both an apron and taxiway will require a rigid pavement with floodlighting, as well as the construction of 7.5m shoulders.[58]
- A new hangar and maintenance facility to be constructed alongside the new apron, with the capacity to hold two aircraft. This hangar would be used for maintenance and repairs, as well as protecting aircraft from destructive weather. It will also comprise working accommodation for maintenance and air crews.
- A new aircraft rinse facility would be required, located beside the hangar, in order to rinse aircraft to remove any air-borne contaminants.[59] This is necessary in order to maintain the aircraft and ensure maximum performance.
- A new munitions storage facility would need to be constructed in a secure location in compliance with explosives and ordnance storage requirements.

- New ancillary administration building to be built beside the new apron in order to separately process ADF personnel. This would also assist in maintaining security protocols by separating civilian and military traffic.

Personnel
A joint civilian–military airport would require accommodation for roughly 50 ADF personnel, plus their families in the case of the permanently posted members.

Ground crew would be required for on-site maintenance and support. The maintenance crew and technicians may be accommodated at the upgraded Manus Island Detention Facility, which includes self-contained accommodation for up to 400 staff.[60] Due to the temporary nature of accommodation for aircrew, it may be possible to house these personnel at the temporary transit accommodation at the Lombrum Base, which is currently in the process of upgrading these facilities as per the P255 tender.[61]

JORN Facilities on Manus Island

A more ambitious 'Strategic Observation Post' option could imagine extending Australia's JORN over-the-horizon radar (OTHR) network by building a transmitter and receiver on Manus Island.

JORN was 'switched on' in 2003 and reached final operational capability in 2014, after half a century of research. It is Australia's first comprehensive early warning system, providing a 24-hour military surveillance of the northern and western approaches to Australia.[62] It comprises three vast transmitter and receiver antenna arrays located in Longreach, Queensland, in Laverton, Western Australia, and Alice Springs in the Northern Territory. These are supported by ionosondes in a dozen locations to continually map the conditions of the ionosphere. JORN has a publicly acknowledged range of 3,000 kilometers, though it is thought to be more, and is said to be able to detect moving vessels down to a small patrol boat or small jet. A JORN site on Manus Island would greatly enhance Australia's ability to observe and track threats across the region.

The eastern and western sides of Manus Island are relatively flat, making land clearing and levelling easier. Manus Island is just over 100 kilometers in length, which means that a transmitter and receiver could be placed on either end and would be far enough away to not interfere with readings.

In addition to the construction of the radar facilities, general infrastructure on the island would also need to be upgraded, most importantly energy production and the road network to connect the JORN sites. According to the 1990 Parliamentary Standing Committee on Public Works report on JORN, the annual power draw by the Queensland and Western Australian radars is 12.7 megawatts each, with each consuming 3.2 million litres of diesel fuel per annum.

The estimated cost for Option 3.1 (only) **$281 million** (see Appendix 3.1)
The estimated cost for Option 3.2 (only) is **$1.011 billion** (see Appendix 3.2)

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Option 4: A Forward Operating Base

A forward operating base on Manus Island would greatly enhance and simplify the ADF's forward operations. It would assist the RAN and RAAF, in particular, to maintain their forces in the areas where they are most needed. A forward operating base could envisage maintaining a permanent ADF presence, on a rotational basis, at Lombrum. Australia and PNG allies could also make use of the base to resupply and maintain their vessels, thereby strengthening Australia's diplomatic relations.

The scale of this option is elastic. After all, a forward operating base could be built to support the ADF's smallest ships and aircraft all the way up to its largest. Here, however, the option discusses a forward operating base for the ADF's largest and most capable ships and aircraft. This is for a number of reasons; however, the three most important are: 1) it provides government with the greatest flexibility to respond to humanitarian and natural disasters, constabulary operations and warfighting, 2) it will enhance Australia's ability to shape and influence the region by increasing the ADF's presence in the region and its value as a security partner, and 3) it will implant the most strategic uncertainty in the minds of our opponents who would need to consider every permutation of how Australia and its allies may use the forward operating base.

While sailing times between Lombrum and many locations in Asia are similar to those from Darwin, Lombrum Naval Base is a far more attractive option for submarine activities. Currently, the RAN's Collins-class submarines have significant transit times to get from HMAS *Stirling* in Perth, WA, on station in Australia's primary area of concern in South East Asia and the South Pacific. While Darwin's potential as a forward operating base for surface vessels is frequently discussed, it is considered unsuitable for hosting submarines due to the shallow surrounding waters. A submarine would have to travel, on the surface, for approximately 250 nautical miles – or 24 hours – to reach a water depth of 100 metres, and submerge.[63]

This makes them extremely vulnerable and gives opponents a good sense of where the boat is headed. Instead, Australian submarines common make port visits in Singapore for refuelling and replenishment. But, in scenarios where the Straits of Malacca and/or South China Sea were contested, submarines would need to be capable of sustained time on station in this area. In contrast, Manus Island is proximate to water hundreds of metres deep immediately outside the harbour in the Bismarck Sea, and not impeded by any obvious maritime choke points.

Requirements to Realise this Strategic Option

The costs and requirements for the Momote Airport would be similar to those outlined in Option 3.1.

In addition, however, this option would include the redevelopment of the wharves and harbour at Lombrum Naval Base. To receive the greatest value from Manus Island's geostrategic position, it would be beneficial for RAN ships and submarines to be able to pull-up directly along the wharf for refuelling and replenishment. It would also include additional demands for housing and utilities. This development work also distinguishes it from the 'mothballed launch pad' that envisaged RAN ships to anchor in the harbour and ferry to shore.

New Wharves and Cranes

The LODA and Nawai wharves would need to be demolished to create space for the construction of new wharves. Two new wharves would need to be constructed in their place, each 255m long and 25m wide. The new wharves – and dredging discussed below – would accommodate any RAN ship or submarine up to and including the Canberra-class LHDs. The new wharves will also include various important add-on structures, such as berthing dolphins, fendering and cathodic protections as well as auxiliary service access points, similar to Naval Operations Support Facilities at Larrakeyah.[64]

Additionally, this option would also procure a telescopic boom crane and a portal jib crane to allow the re-arming of RAN vessels and the offloading/onloading of shipping containers.

Harbour Dredge

LODA wharf has a depth of 8–9.6m. This only allows a few ships in the Australian fleet to use the wharf, namely the Anzac-class frigates and HMAS *Choules*. Harbour dredging is required to deepen the harbour by at least another 2 metres. Material from this dredging could be used to extend the seawall between the two new wharves.[65]

Fuel

The existing 550,000L diesel tanks at Lombrum are insufficient to support a forward operating base. The upgrade would likely need two ADF-10 fuel tanks with a total capacity of 3.5 to 4 million litres of fuel, with pumps and pipes for feeding fuel to vessels.[66]

Accommodation

Currently, the Detention Facility has accommodation for approximately 600 personnel. This is enough living space for the estimated number of ADF personnel to be assigned to the FOB. However, there is the need to complete the refurbishment of the faculties to make them suitable for ADF personnel and their families. For example, lighting, the potable water supply, and the sleeping quarters, would need to be refurbished.

An estimated 700 Australian Public Service and contracted personnel would be required to maintain Lombrum and support operations. Security requirements will be similar to that in Option 3 (i.e. new perimeter fencing, cameras and local security contractors to monitor), but will also include the naval base in addition to the airport.

Power Facilities

This work will introduce additional power supply in the form of additional diesel-powered generators along with necessary feeders and cables for supplying shore-to-ship power to any berthed vessels at the FOB via cope points installed along the wharves. In addition, power will also be supplied to various infrastructure and equipment in the vicinity of the wharves, such as portal cranes and lighting. Information on this item's pricing is based on the reported price for similar line items in the Larrakeyah Barracks Redevelopment Project.

Munition Storage Facilities and a New Warehouse

This option would require enhanced munition storage. The option might foresee something like two NAVFAC Marianas Munitions Storage Igloos. These Igloos stand at roughly 8 metres wide, 24 metres long and 3 metres high and made of pre-cast walls and roof panels and waterproofed inside and out. Subsidiary facilities include a generator house, transformer pad with enclosures, and two switch pad enclosures.[67]

Manus Island would also require a new warehouse for spare equipment and parts to perform light maintenance on RAN vessels. These facilities could be built in the hardstand area of the Lombrum Naval Base.

The estimated total cost of Option 4 is **$807.1 million** (see Appendix 4)

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Option 5: A Geostrategic Strongpoint

Manus Province is the gateway to Melanesia. Its location at the northern tip of the Melanesian Arc means that it is ideally located to assert presence throughout the region. As a geostrategic strongpoint, Manus Island could fill two important roles. First, within Australia's defence policy, Lombrum Base could be redeveloped into the point of Australia's geopolitical spear. It could be used offensively to project influence through the Indo-Pacific and as a launch pad for sea control operations. Defensively, it could be the most forward hardpoint in Australia's maritime layered defence that will complicate, if not prevent, an opponent's sea power projection through the Melanesia Arc and beyond.[68] Turning Manus Island into a geostrategic strongpoint that boasted its own permanent surveillance capabilities and defences, and could also support the ADF's sea, land and air operations through the Indo-Pacific, would significantly complicate any hostile power's strategic ambitions through Melanesia and towards the Australian mainland.

Second, it could also be integrated into the United States' emerging Indo-Pacific strategy. This strategy is still being refined; however, there are strong clues that Washington is increasingly favouring a maritime 'chain' strategy. It appears by different names, by different authors, including, "tightening the chain",[69] "inside-out maritime strategy",[70] "porcupine strategy",[71] "Blue A2/AD",[72] "active denial",[73] and "island forts".[74] Taken together, however, the general direction that the United States Indo-Pacific strategy is moving towards appears increasingly clear. Manus Island is ideally located to be a link in this chain. Furthermore, it would rest well with Australia's distinct 'way of war'. That is, since World War I when the Australian Divisions of the 1st AIF took responsibility for an assigned stretch of the Western Front, through to Phước Tuy Province during the Vietnam War, and Uruzgan Province in Afghanistan, Australia has long taken responsibility for a sub-area of a wider allied campaign.

Manus would be one link in the geostrategic chain that stretched across the leading edge of the South Pacific.[75] The distance between Manus and Gaum is approximately 1,750 kilometres. The F-35 has a combat radius of 1,093 km with its internal fuel tanks. So, even before we allow for inflight refuelling and external tanks, RAAF F-35s flown from Manus and USAF F-35s flown from Gaum could provide effective overlapping air-combat capabilities.[76] It is easy to imagine that the Manus battlespace surveillance and management system could be integrated with those on Guam, to become a single integrated system.

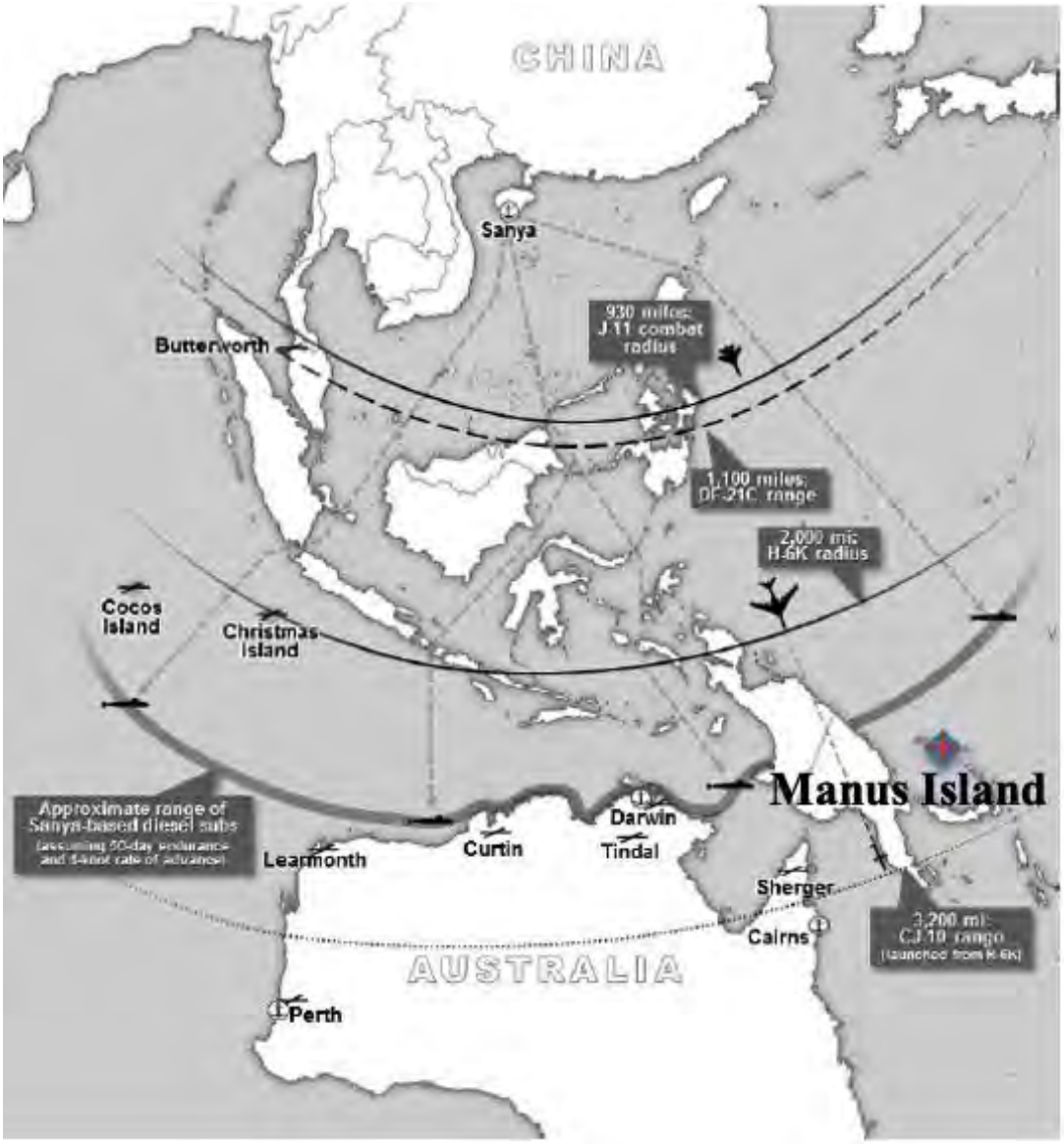
A constant battle within Australia defence policy circles is between those who believe Australia should plan to defend itself with or without the United States. Strategic thinkers such as Paul Dibb and Hugh White usually conclude that Australia requires a layered maritime defence.

The other school of thought argues that Australia's security is best ensured by a close, interdependent, relationship with the United States. An Australian maritime strongpoint on Manus Island simultaneously works towards both these strategic goals.

US Partnership

To be credible, however, this option would require the participation of the United States. The costs and relevant expertise would make it difficult for Australia to shoulder the responsibility unilaterally. However, there are several reasons to be hopeful that the United States would look favourably upon developing a significant base in the Manus Province. First, the United States is cognisant that its existing bases in Japan, South Korea and Gaum are increasingly vulnerable to a Chinese missile saturation campaign in the opening stages of a conflict. Over the past decade, the Chinese Rocket Force has made significant advances in the quantity, precision, warhead size and survivability of its ballistic missile force.

Figure 3: China's Military Reach



Source: Jim Thomas, Zack Cooper and Iskander Rehman, *Gateway to the Indo-Pacific: Australian Defense Strategy and the Future of the Australia–U.S. Alliance* (Washington, DC: Center for Strategic and Budgetary Assessments, 2013), p. 14.

Second, maintaining a relatively small number of large bases has resulted in rising tensions between the United States military and the local populations. These tensions have resulted from servicemen's interactions with the local populations (including some high-profile rape cases), noise, pollution, environmental degradation, traffic congestion and the risks associated with operating bases during peacetime and potentially during war.[77] Okinawans, in particular, have long resented disproportionately absorbing the risks and costs of hosting American bases, while the rest of Japan (and the wider region for that matter) benefits from the security it provides.[78] Increasing the number bases and, thereby, spreading the social burden would mollify some of the tensions that have arisen.

Finally, diversifying its basing options in the Pacific would significantly strengthen the credibility of America's conventional deterrence strategy. As Toshi Yoshihara points out, "the Chinese are acutely aware of the apparent American dependence on a few bases to project power. Should access to and use of these bases be denied for political or military reasons, they reason, Washington's regional strategy could quickly unravel."[79]

Requirements to Realise this Strategic Option

Under this option, there would be a need to accommodate a significant force, on a permanent basis. It is envisaged that the base could host up to 1,750 Australian, American, Papua New Guinean and allied personnel. As it would be hosting a greater number of personnel and platforms permanently, as well as more frequent visits, it would require all the upgrades mentioned in previous options, except on a larger scale (e.g. munition storage, water, warehouses, accommodation and base security).

In addition, it will also have its own battlespace management system and self-defence weapons.

Battlespace Monitoring System and Sensors
The base would have its own dedicated anti-air and anti-missile defences. The base could integrate its battlespace management systems through Wakulda (formerly known as the Vigilaire air surveillance system) or a similar system. These could be linked with NASAMS (National Advanced Surface to Air Missiles).

Although not costed into the current option, an integrated undersea surveillance system that included a passive array sensor system and hydrophones between Manus and Gaum (1,750 kilometres away) could complement the JORN and provide the US and Australian commanders with a clear picture of the aerial, surface and subsurface battlespace.

Aircraft

The base would likely be assigned its own multipurpose and ASW helicopters (e.g. MRH-90 Taipans and MH-60R Seahawks). In addition, although not assigned to the command, it is envisaged that air-superiority, anti-ship, ASW and surveillance aircraft (including F-35A, F/A-18F, P-8A, E-7A, KC-30A, MH-60R, and MQ-4C Tritons) would all be a constant presence on the island. In particular, a small number of F-35A, F/A/-18F, P-8A and MQ-4C would maintain a constant presence with larger numbers being deployed during exercises and operations. Live ordinance would be stored on site to allow these platforms to perform their full-range of combat and non-kinetic operations and activities, in particular AGM-158C LRASM[80] would provide the base with its main anti-ship capabilities launched from a F-35A, F/A/-18F or P-8A.[81]

Headquarters and Naval Intelligence Buildings

The larger command will require new buildings to support operations and base management. These could be built on and around the existing PNGDF junior sailor accommodation, which would most likely be incorporated in the new accommodation complex. These new buildings will house: Manus Island HQ, harbour command, ICT, logistics, JORN and intelligence units.

The estimated cost of Option 5 is **$3.737 billion** (see Appendix 5)

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Conclusion

The strategic options outlined in this report have significance far greater than the future of Manus Island. In many ways, the future of Manus Island can be viewed as a symbol of Australia's future strategic policy in the Indo-Pacific region. That is, the decision on which possible future option appeals the most will largely turn on how Australia's future defence strategy is viewed.

For example, if readers believe that the allied defence posture in the Indo-Pacific should seek to establish maritime chains that crisscross the region and can mutually reinforce each other, then the strategic strongpoint would likely be their preferred option. The ADF has a long history of assuming responsibility for a sub-region within a larger US-led allied campaign. If this model was to be followed in a future Indo-Pacific conventional maritime deterrence strategy, then Australia could be expected to assume responsibility for one-link in the chain. Geostrategically, it would follow that the South Pacific part of the chain would run between Gaum and Manus with northern Australia providing strategic depth and reinforcing the chain. This chain would look to establish maritime supremacy and sea control, when needed, while being able to project units forward into China's near seas for sea denial operations.

However, readers who believe that deterrent chains are too defensive in orientation and, instead, Australia should be capable of projecting sea and air power deep into East Asia, then the forward operating base might be appealing. This is not to say that the ADF, and Navy in particular, cannot already deploy forces throughout the region – they of course have a proven ability to do so. Yet, as the US Navy can attest, forward operating bases provide operational flexibility with platforms being able to remain on station longer, re-crew in theatre, or reconfigure their magazines faster and more easily, while also reducing transit times and sea days not in theatre.

Finally, those readers that prefer a continental defence approach to Australia's defence planning would likely be more attracted to the idea of using Manus as an observation post or perhaps a maintenances hub for the Guardian-class patrol boats.

Viewed through this prism, the debate over the future of Manus Island is a proxy for the much broader and more extensive reimagining of Australia's defence policy and strategy. It is telling, therefore, that despite the many government announcements there remains little tangible development on Manus Island. It would seem that changes to Manus and Australian strategic policy remain glacially slow, while geopolitical shifts are happening much faster.

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Appendices 1–5

Notes to appendices: The costings for the various options are intended to be broadly illustrative, rather than constituting an exhaustive economic study or formal proposal. Data has been collected with an 'all-source fusion' methodology.[82] Various cost estimation methodologies were consulted,[83] but a simple marginal cost approach (excluding, *inter alia*, sunk and ongoing costs) was adopted. All prices are quoted in AUD.

Appendix 1: Pacific Slip's estimated cost			
Line Item	**Description**	**Estimated Cost**	**Source**
Construction of slipway	A slipway to accommodate 39.5m Guardian-class patrol vessels.	~$23.2m	Estimated from proposed slipway in Rozelle, Sydney.[84]
Refurbishment of housing facilities	Refurbishment of one third of former detention facility staff housing.	~$1m	Estimated from the cost of refurbishing similar facilities at Lombrum.[85]
Warehouse upgrade	Replacement of WWII-era Quonset buildings with maintenance halls	~$200,000	Estimated from previously completed Quonset building replacements.[86]
Mobile Boat Trailer	200-ton mobile boat trailer, e.g. Cimolai MBT-200	~$650,000	Pricing information provided by Cimolai.[87]
Marine Hoist	220-ton mobile boat hoist, e.g. Cimolai MBH-200	~$1.5m	Pricing information provided by Cimolai.[88]

Appendix 2: Mothballed Launchpad estimates			
Line Item	**Description**	**Estimated Cost**	**Source**
Design and build of Tent City	Management of all the design, labour, materials, delivery, plant, equipment, access, supervision, shipping and logistics to build the 'tent city'.	~$247m	Manus Offshore Processing Centre, Decmil, 2020.[89]
Runway Extension and Airfield Infrastructure	Phase 1: Dredging up to 1 million m^3 for Land Reclamation	~$127m	Pump Industry.[90]
Runway Extension and Airfield Infrastructure	Phase 2: Construction of Runway Infrastructure	~$40m	Estimated from the RAAF Williamstown runway extension project[91] as well as the Momote Airport Upgrade in 2016.[92]

Appendix 3.1: Strategic Observation Post			
Line Items	**Description**	**Estimated Cost**	**Sources**
Runway Extension and Airfield Infrastructure	Phase 1: Dredging up to 1 million m^3 for Land Reclamation	~$127m	Pump Industry.[93]
Runway Extension and Airfield Infrastructure	Phase 2: Construction of Runway Infrastructure	~$40m	Estimated from the RAAF Williamstown runway extension project[94] as well as the Momote Airport Upgrade in 2016.[95]

Construction of Airport Infrastructure	Construction of hanger, maintenance and repair facility, aircraft rinse facility, munitions storage facility, new apron and taxiway, new administration building and minor works	~$90m	Estimated based on the contracted cost of the RAAF Darwin Upgrade as part of the Air 7000 Phase 2b Project[96]
New fuel storage facility (fuel farm)	Demolition, earthworks, pipelines, and in-ground infrastructure	~$10m	Estimated from the fuel farm installation for the Larrakayeh Barracks Redevelopment Project.[97]
Extension of power supply and site-wide electrical	Installation of a high voltage (HV) power supply, including drilling, trenching, and excavation, as well as site-wide electrical	~$10m	Estimated from the power supply upgrade as part of the Larrakayeh Barracks Redevelopment Project.[98]
Securing of Momote Airport	Defence security services, secure IT network, Class 2 perimeter fencing, new access and connection roads, guardhouses, vehicle inspection bays, and roadblocks, and electronic security	~$4m	Estimated based on security infrastructure upgrades currently undertaken as part of the Larrakeyah Barracks Redevelopment Project[99]
Appendix 3.2: Strategic Observation Post with JORN			
Radio transmitter and receiver sites	Cost of construction.	~$1bn	Comparable to original 'Phase 3' $1.1bn design and build cost[100] and 'Phase 6' $1.2bn ex-upgrades.[101] Parliamentary Standing Committee on Public Works Report relating to the Jindalee Over-the-Horizon-Radar[102]

Power generation	Cost of procuring four diesel power generators capable of powering the radar sites.	~$1m	Cummins Powered Diesel Generator ($235,000 each) via Able Sales.[103]
New fuel storage facility (fuel farm)	Demolition, earthworks, pipelines, and in-ground infrastructure	~$10m	Estimated from the fuel farm installation for the Larrakayeh Barracks Redevelopment Project[104]

Appendix 4: Forward Operating Base			
Line Item	**Description**	**Estimated Cost**	**Pricing Source**
3.1 Strategic Observation Post	Momote runway upgrade and airside infrastructure.	~$281m	As Estimated from the RAAF Williamstown runway extension project[105] as well as the Momote Airport Upgrade in 2016.[106]
Dredging of Lombrum Bay	Remove up to 1 million m^3 to enable LHDs access to Lombrum.	~$127m	Pump Industry.[107]
Construction of New Wharves	The two existing wharves at Lombrum, LODA and Nawai will be demolished and two new and larger wharves will be constructed in their place to allow for the berthing of large RAN vessels.	~ $213m	Defence Connect.[108]
Upgrade to Fuel Supply Facilities (storage, processor, pipelines)	Demolition, earthworks, pipelines, and in-ground infrastructure	~$10m	See Larrakeyah Redevelopment Program. [109]
Upgrade to Existing Detention Facility	The detention centre will receive complete refurbishment to its living quarters and various amenities in	~ $100m	Extrapolated from the cost of refurbishing similar

	order to provide suitable living space for approximately 600 ADF personnel.		facilities at Lombrum.[110] And upgrades to Christmas Island.[111]
Upgrade to Power Facilities	Required for supplying power to both berthed vessels and various equipment in wharves area.	~ $10m	See Larrakeyah Redevelopment Program.[112]
Construction of Munition Storage Facilities	Used to store vital defence resources for the purpose of re-arming RAN vessels.	~ $8.6m	Estimate based on USD$43 million contract for 20 Igloos at Anderson, Guam.[113]
Warehouse and Equipment Storehouses	For the purpose of storing spare parts and military-grade equipment.	~ $2.5m	See Larrakeyah Redevelopment Program.[114]
Portal Jib Crane	Used to move shipping containers from port to ship and vice versa.	~ $63.5m	Via Kone.[115]
Telescopic Boom Crane – GMK 4080-2	For the purpose of re-loading vertical launch systems.	~ $1.5m	Grove by Manitowoc, via TRT Australia. POA.[116]

Appendix 5: Geostrategic Strongpoint			
Line Items	**Description**	**Estimated Cost**	**Pricing Source**
3.1 Strategic Observation Post	Momote runway upgrade and airside infrastructure.	~$281m	Estimated from the RAAF Williamstown runway extension project[117] as well as the Momote Airport Upgrade in 2016.[118]

Dredging of Lombrum Bay	Remove up to 1 million m^3 to enable LHDs access to Lombrum.	~$127m	Pump Industry.[119]
Construction of New Wharves	The two existing wharves at Lombrum, LODA and Nawai will be demolished and two new and larger wharves will be constructed in their place to allow for the berthing of large RAN vessels.	~ $213m	Defence Connect.[120]
Pacific Dock Wall	Accommodate Canberra-class LHD, Hobart DDG. Inclusive of serviced connections.	~ $500m	The pricing was estimated from patrol boat wharf extensions to HMAS Coonawarra.[121]
Submarine Wharf	- Submarine berthing - Berthing dolphins - Smaller RAN/PNGDF vessels - Inclusive of serviced connections.	~ $350m	See Larrakeyah Redevelopment Program.[122]
Marine Hoist/Railway Crane	- Railway (Pacific Docking Wall Top) - Telescopic Boom Crane – GMK 4080-2 - Railway Jib Crane	~ $65m	Via Kone.[123] Manitowoc, via TRT Australia.[124]
Fuel Storage Facility /Utilities	8 million litre fuel tank on top of the upgraded P225 to support the quantity necessary for the new patrol boat program 23m diameter, 8ML fixed cone roof tank for the storage of diesel.	~ $15m	Estimated from Honiara Fuel Storage Tank Project [125] and the fuel farm for the Larrakeyah Redevelopment Project.[126]
Harbour Office/Logistics/ Naval Intelligence	- Office and intelligence buildings - Logistics/support - ICT Infrastructure	~ $100m	Estimate from Decmil and Department of Defence.[127]

Road Infrastructure	Redeveloping the roads between Lombrum, Momote and the JORN receiver and transmitter	~ $800m	Departmant of infrastructure estimated road construction cost.[128]
Defence Systems	Vigilare Air Surveillance	~ $275m	Via Boeing[129] and media.[130]
Defence Systems	JORN (only):	~ $1.011b	See Appendix 3.2 above.

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*The following corrections have been made to this report. This electronic file was updated on 30 June 2022.

Page 6, line 2: Deleted: "and interviews"

Page 6, line 4: Deleted: "interviews and"

Page 6, line 5: Deleted: "and interviews"