NAVAL SHIPBUILDING

Australia's Underlying Insurance Policy

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Glossary of Acronyms & Abbreviations
ADF: Australian Defence Force
AWD: Air Warfare Destroyer (SEA4000)
AWDX: Replacement for SEA4000 Air Warfare Destroyers
CBRN: Chemical Biological Radiological Nuclear
CDT: Clearance Diving Team
DFAT: Department of Foreign Affairs and Trade
DWP: Defence White Paper
FF: Future Frigate (SEA5000)
FFX: Replacement for SEA5000 Future Frigates
FOCT: First-of-Class Trials
FSM: Future Submarine (SEA1000)
FSMX: Replacement for SEA1000 Future Submarines
LHD: Landing Helicopter Dock
LHDX: Replacement for Canberra Class Landing Helicopter Docks
MHX: Replacement for Huon Class Mine Hunters
OHX: Replacement current Oceanographic Hydrographic ships
OPV: Offshore Patrol Vessel (SEA1180)
OPVX: Replacement for SEA1180 Offshore Patrol Vessels
RAAF: Royal Australian Air Force
RAN: Royal Australian Navy
SAR: Search and Rescue
SCI: Sensitive Compartmentalised Information
SCS: South China Sea
TAG: Tactical Assault Group

EXECUTIVE SUMMARY

Since 1945, successive Australian Government's have reduced national defence spending due to America's global strategic primacy and several decades of no direct military threats.[1] Combined with significant increases in the cost of sustaining technologically advanced defence forces, the result has been a contraction in the size of the Royal Australian Navy (RAN) fleet.[2] This phenomenon has encouraged successive Australian Government's to order small production runs of surface ship and submarine classes.[3] Consequently, Australia's naval shipbuilding industry has been severely undermined by significant inefficiencies, stemming from the inefficient use of program fixed-costs and insufficient continuous work to retain skilled shipbuilding workforces.[4]

For the first time in decades, the Australian Government has committed itself to the development and indefinite sustainment of a permanent Australian naval shipbuilding industry.[5] As articulated by the 2016 Defence White Paper (DWP), and subsequent announcements, the industry will feature three continuous naval shipbuilding production lines: one for major surface ships, one for minor surface ships and one for submarines.[6]

However, this continuous-build policy has attracted three criticisms with considerable merit. The first criticism is that the policy was just to win votes at the 2016 Federal Election.[7] The second criticism is that it would be significantly cheaper to acquire Australia's surface ships and submarines from offshore shipyards.[8] The third criticism is that it would be faster to acquire Australia's surface ships and submarines from offshore shipyards.[9] Despite these meritorious points, the reality is that Australia's continuous shipbuilding policy is not about winning votes, finding the cheapest solution or the fastest solution. It is rather about bolstering Australia's National Security and facilitating Australia's economic rejuvenation.

In order to understand the importance of Australia's naval shipbuilding industry, one must understand the Australian Government's tri-layered national insurance policy. The first layer of insurance is diplomacy. However, diplomacy will not always prevail thus necessitating a second layer of insurance, the Australian Defence Force (ADF). The ADF provides the Australian Government with various protective options to insulate Australian Citizens and Territories from a wide range of highly undesirable scenarios.

The third layer of insurance is Australia's naval shipbuilding industry, and is critical for two distinct reasons. Firstly, a continuous-build program gives the Australian Government the flexibility to expand the RAN with around five years notice. Secondly, a continuous-build program gives Australian counter-intelligence and security agencies the greatest opportunity to prevent third-party foreign intelligence services from gaining unauthorised access to sensitive information, as well as access to the RAN's future naval vessels.

The reality is that all three insurance policies are required to underwrite Australia's National Security. Diplomacy prevents and helps manage crises or conflicts. If conflicts or threats do arise, the ADF provides a range of protective response options. Australia's naval shipbuilding industry underpins the ADF's capability to carry out its duty in protecting Australian Citizens and Territories from highly undesirable outcomes. Ultimately, Australia's continuous naval shipbuilding policy provides the government with the greatest flexibility over how, when and in what numbers it is able to supply the RAN with critical surface and undersea capabilities.

1. BACKGROUNDER

Since 1945, Australia's ultimate security has been underwritten by the United States and its global strategic primacy.[10] Operating under Americas' strategic primacy umbrella has significantly reduced the scale and scope of credible contingencies that the ADF would have to handle independently.[11] For instance, the ADF does not require a nuclear deterrent as this is provided by the United States Armed Forces, under the US Alliance framework.[12]

When combined with a lack of direct military threats, over several decades, successive Australian Government's have lowered national defence spending. For instance, during World War II (1943-1944) Australia spent 37% of GDP on national defence.[13] By the Korean War (early 1950s) defence spending amounted to just under 5% of GDP, and just over 4% of GDP during the Vietnam War (mid-1960s).[14] Since 2000, Australian defence spending has never exceeded 1.94% of GDP, with the lowest point recorded in 2012-2013 at just 1.6%.[15]

The result of a shrinking defence budget has been a contraction of the RAN fleet; a phenomenon that has been considerably aided by rapid increases in the cost of sustaining technologically advanced forces[i].[16] For instance, at the end of World War II the RAN had a fleet of 337 vessels. In 1987 the RAN had a total of 50 vessels[ii], including all submarines and ships. In 2006 the RAN fleet numbered just 48 vessels[iii].[17] Under the 2009 DWP the RAN would have peaked at 54 vessels.[18]

The progressive contraction of the RAN fleet, as well as the Australian Government's persistent orders for short production runs of naval vessels, has dealt the Australian naval shipbuilding industry an erratic workload.[19] This has contributed to significant inefficiencies, schedule delays and bloated program costs.[20] The critical link is that shipyards have been forced to absorb the significant cost of developing shipyard infrastructure and skilled

[i] US Defence spending data, dating back to the 1950s, indicates that the average cost of sustaining technologically sophisticated military hardware has grown by 3% per annum on top of inflation. As a result, the United States Armed Forces has shrunk. The force structure of the US Army has approximately halved and the number of US Navy/Marine Corps/Air Force ships and aircraft has shrunk by around 75%.

[ii] Including six submarines, 12 frigates & destroyers, 20 patrol boats, one heavy amphibious ship, six heavy landing craft, two replenishment & maintenance ships, two mine-hunter ships and one oceanographic research ship

[iii] Including six submarines, 17 major fleet units (includes frigates and large support ships) and 31 minor fleet units

workforces at the start of a program, only to discard the skilled workforce and underutilise shipyard infrastructure investments at the end.[21]

However, the Australian naval shipbuilding industry has not always been inefficient. In fact, the ANZAC Class Frigate Program delivered eight ships to the RAN plus two for the Royal New Zealand Navy, and remains a shining example of the industry at its best.[22] All ANZAC Frigates were delivered incredibly close to the programs schedule and budget.[23] This is proof that the Australian naval shipbuilding industry is capable of constructing naval vessels in a timely and cost-efficient manner.

Developing a cost and schedule efficient naval shipbuilding industry will require stable, long-term demand for RAN vessels, as well as longer production runs with minimal design changes.[24] Minimal changes is an essential factor since it enables shipyard workforces to maximise the exploitation of the 'learning curve' phenomenon[iv].[25] It is also important to note that longer production runs increase the utilisation of a shipbuilding programs fixed-costs by spreading them over a larger number of hulls, thereby contributing to a decrease in the average cost per vessel.[26] A naval shipbuilding programs fixed-costs include those associated with engineering and program management overheads in addition to the cost of upgrading shipyard infrastructure, as may be required to enable construction of a new submarine or ship class.[27]

[iv] **Learning Curve:** the principle that a production lines efficiency will increase with each additional unit of output. In shipbuilding learning curves of 8-10% are typical, meaning that the time required to complete each successive unit of production is generally 8-10% less than that required by the previous unit.

2. 2016 DEFENCE WHITE PAPER

2.1 Australia's Naval Shipbuilding Policy

The 2016 DWP, in addition to subsequent press releases, committed the Australian Government to funding a permanent Australian naval shipbuilding industry.[28] The 2016 DWP mentioned three specific continuous naval shipbuilding production lines, one for major surface ships, one for minor surface ships and one for submarines.[29] The official justification for this continuous-build policy is to:

- Ensure Australia's future security through a "sovereign" naval shipbuilding capability.[30]
- Encourage shipbuilders to invest in improved naval construction capabilities.[31]
- Enable shipbuilders to develop and plan their long-term workforce requirements.[32]
- Transition Australia to a "21st century economy" by supporting the development and sustainment of "jobs of the future" across the fields of science, technology and innovation.[33]

2.1.1. Major Surface Ship Production Line

In 2015, the RAND Corporation found that Australia could fill gaps between major surface ship classes with the construction of Offshore Patrol Vessels (OPV), so as to retain skilled workforces.[34] In fact, the Australian Government has chosen to build two OPVs in Adelaide from 2018 to sustain the shipyard until the start of the Future Frigates in 2020.[35] RAND also assessed that with a fleet of 14 major surface ships[v], and vigilant management by the Department of Defence, Australia can sustain a continuous naval shipbuilding industry if it keeps ships in service for 25 to 30 years.[36]

A simulated projection of how Australia could manage a continuous major ship production line is outlined in Table 2. With a build time of 60 months[vi] Future Frigates could be commissioned at 18 month intervals, with the 9th and final FF-9 commissioned at the start of 2037 (see Table 2).[37] The class of replacement Air Warfare Destroyers (AWD), AWDX, could then begin construction in mid-2035 at 18 month intervals, with a build time of 60 months[vii] per ship.[38] This would enable the lead replacement ship, AWDX-1, to be commissioned prior

[v] Three AWDs, nine Future Frigates and two LHDs
[vi] 60 months is around the time required to construct a F590 Italian FREMM Frigate, one design that is competing in the SEA5000 Future Frigate Competitive Evaluation Process.
[vii] 60 months is around the time required to construct one AWD

to the decommissioning of the lead AWD, *HMAS Hobart III,* in 2041 (see Tables 1 & 2).[39] The class of replacement Landing Helicopter Docks (LHD), LHDX, could commence construction in early 2042 at 18 month intervals, with 72 months[viii] of construction time per ship.[40] This would enable the lead ship LHDX-1 to be commissioned prior to the decommissioning of the lead LHD, *HMAS Canberra III*, in 2049 (see Tables 1 & 2).[41] Finally, the post-SEA5000 replacement frigates (FFX) could begin construction in early 2044 at 18 month intervals, with an assumed build time of 60 months per ship. This would allow the lead replacement frigate, FFX-1, to be commissioned in early 2049 when the lead SEA5000 Future Frigate FF-1 is decommissioned (see Tables 1 & 2).

Nevertheless, as eminent defence analysts Andrew Davies and Mark Thompson would point out, the fundamental problem with a mixed production line is that it risks limiting the maximum efficiency that a shipyard can attain through the 'learning curve'[ix].[42] This is because the 'learning curve' relies on units of production being identical or near identical in design, so as to maximise the learning and efficiency of shipyard workforces with each additional unit of output.[43] The obvious issue with a mixed production line is that LHDs are radically different from frigates or destroyers. For starters the LHDs displace around 27,500 tons versus a F590 FREMM Frigate at 6,500 tons or a Hobart Class AWD at 7,000 tons.[44] Consequently, it is reasonable to infer that shipyard infrastructure and workforce demands would differ between these ship types.

TABLE 1. PROJECTED MAJOR SHIP SERVICE DATES

	First of Class Commissioned	First of Class Decommissioned	Anticipated Service Life
Air Warfare Destroyer	2017[x]	2041	24 years
Landing Helicopter Dock	2014[xi]	2049	34 years
Future Frigate	2025[xii]	2049	24 years

Source: Commonwealth of Australia & RAND Corporation.[45]

[viii] 72 months is around the time taken to construct a single LHD of the design currently used by the RAN.

[ix] **Learning Curve:** the principle that a production lines efficiency will increase with each additional unit of output. In shipbuilding learning curves of 8-10% are typical, meaning that the time required to complete each successive unit of production is generally 8-10% less than that required by the previous unit.

[x] March 2017 is the projected date for the first AWD, *HMAS Hobart III*, to be commissioned.

[xi] November 2014 was the date that the first LHD, *HMAS Canberra III,* was commissioned.

[xii] Assumes construction starts in 2020 and a build time of 60 months per frigate. Build time is based on RAND Corporation figures for the construction of a single FREMM Frigate.

TABLE 2. PROJECTED TIMELINE OF FUTURE MAJOR SHIPS

Start/Launch Date		SEA5000 Future Frigate (60 month build)	AWD Replacement (AWDX) (60 month build)	LHD Replacement (LHDX) (72 month build)	Frigate Replacement (FFX) (60 month build)
2020	1-Jan	FF-1 Keel laid			
	1-Jul				
2021	1-Jan				
	1-Jul	FF-2 Keel laid			
2022	1-Jan				
	1-Jul				
2023	1-Jan	FF-3 Keel laid			
	1-Jul				
2024	1-Jan				
	1-Jul	FF-4 Keel laid			
2025	1-Jan	FF-1 Commissioned			
	1-Jul				
2026	1-Jan	FF-5 Keel laid			
	1-Jul	FF-2 Commissioned			
2027	1-Jan				
	1-Jul	FF-6 Keel laid			
2028	1-Jan	FF-3 Commissioned			
	1-Jul				
2029	1-Jan	FF-7 Keel laid			
	1-Jul	FF-4 Commissioned			
2030	1-Jan				
	1-Jul	FF-8 Keel laid			
2031	1-Jan	FF-5 Commissioned			
	1-Jul				
2032	1-Jan	FF-9 Keel laid			
	1-Jul	FF-6 Commissioned			
2033	1-Jan				
	1-Jul				
2034	1-Jan	FF-7 Commissioned			
	1-Jul				
2035	1-Jan				
	1-Jul	FF-8 Commissioned	AWDX-1 Keel laid		
2036	1-Jan				
	1-Jul				
2037	1-Jan	FF-9 Commissioned	AWDX-2 Keel laid		
	1-Jul				
2038	1-Jan				
	1-Jul		AWDX-3 Keel laid		
2039	1-Jan				
	1-Jul				
2040	1-Jan				
	1-Jul		AWDX-1 Commissioned		
2041	1-Jan		HMAS Hobart III Decommissioned		
	1-Jul				
2042	1-Jan		AWDX-2 Commissioned	LHDX-1 Keel laid	
	1-Jul				
2043	1-Jan				
	1-Jul		AWDX-3 Commissioned	LHDX-2 Keel laid	
2044	1-Jan				FFX-1 Keel laid
	1-Jul				
2045	1-Jan				
	1-Jul				FFX-2 Keel laid
2046	1-Jan				
	1-Jul				
2047	1-Jan				FFX-3 Keel laid
	1-Jul				
2048	1-Jan			LHDX-1 Commissioned	
	1-Jul				FFX-4 Keel laid
2049	1-Jan	FF-1 Decommissioned		HMAS Canberra III Decommissioned	FFX-1 Commissioned
	1-Jul			LHDX-2 Commissioned	
2050	1-Jan				
	1-Jul				FFX-2 Commissioned

Source: RAND Corporation & Commonwealth of Australia.[46]

2.1.2. Minor Surface Ship Production Line

The initial two OPVs will be built in Adelaide between 2018 and 2020; construction of the remaining 10 OPVs will then be transferred to Western Australia, to run from 2020 to 2030.[47] From 2030 the RAN's existing four Huon Class Mine Hunters will need to be replaced, with additional future work provided by the replacement of the RAN's six hydrographic/oceanographic survey ships.[48] This brings the total number of minor surface ships to 22, with 20 to be constructed in Western Australia.

A simulated projection of how Australia could manage its 20 minor surface ships to deliver a continuous production line is outlined in Table 4. If we assume that OPVs take 36 months[xiii] to build and are delivered at 12 month intervals, the keel of OPV-3 would be laid in early 2020, with OPV-12 commissioned in early 2032 (see Table 4). If we assume that each of the replacement Mine Hunter (MHX) and replacement Oceanographic Hydrographic (OHX) ships take 24 months[xiv] to construct, and are delivered at 12 month intervals, the keel for MHX-1 would be laid in early 2031, before the end of work on the OPV production line (see Table 4).[49] This would enable the fourth and final Mine Hunter MHX-4 to be commissioned in early 2036 (see Table 4). The lead ship OHX-1 could be laid down in early 2035, with the sixth and final ship OHX-6 commissioned in early 2042 (see Table 4). At the start of 2042 there would be three years before the lead ship OPV-1 is decommissioned in early 2045 (see Table 4). To prevent a capability gap, the keel for the lead SEA1180 OPV replacement (OPVX) could be laid in early 2041, ensuring that OPVX-1 is commissioned in early 2044 (see Table 4).

TABLE 3. PROJECTED MINOR SHIP SERVICE DATES

	First of Class Commissioning	First of Class Decommissioning	Service Life
SEA1180 OPV	2021[xv]	2045	24 years
Mine Hunter Replacement (MHX)	2033	2057	24 years
Oceanographic Hydrographic Replacement (OHX)	2037	2061	24 years
SEA1180 OPV Replacement (OPVX)	2044	2068	24 years

Source: Commonwealth of Australia & RAND Corporation.[50]

[xiii] 36 months is the time it would take to construct one 90 meter OPV displacing 1500 tons, as assessed by the RAND Corporation.

[xiv] 24 months is the time it would take to construct one 70 meter Littoral multirole vessel displacing 1000 tons, as assessed by the RAND Corporation. 1197 tons is the average of the following current RAN ship classes: the Huon Class Mine Hunter at 720 tons, the Leeuwin Class oceanographic/hydrographic ship at 2550 tons, the Paluma Class oceanographic/hydrographic ship at 320 tons. It is therefore assessed that the replacement Mine Hunter ships (MHX) and replacement Oceanographic Hydrographic ships (OHX) will displace around 1000 tons each, thus 24 months is an appropriate time to allocate for the projected construction of these vessels.

[xv] 2021 is the projected commissioning date of the lead SEA1180 OPV, based on OPV-1 starting construction in 2018 with a build time of 36 months.

TABLE 4. PROJECTED TIMELINE OF FUTURE MINOR SHIPS

Start/Launch Date		SEA1180 OPV (36 month build)	Mine Replacement (MHX) (24 month build)	Oceanographic Replacement (OHX) (24 month build)	SEA1180 OPV Replacement (OPVX) (36 month build)
2020	1-Jan	*OPV-3 Keel laid*			
	1-Jul				
2021	1-Jan	*OPV-4 Keel + OPV-1 Commiss.*			
	1-Jul				
2022	1-Jan	*OPV-5 Keel + OPV-2 Commiss.*			
	1-Jul				
2023	1-Jan	*OPV-6 laid + OPV-3 Commiss.*			
	1-Jul				
2024	1-Jan	*OPV-7 laid + OPV-4 Commiss.*			
	1-Jul				
2025	1-Jan	*OPV-8 laid + OPV-5 Commiss.*			
	1-Jul				
2026	1-Jan	*OPV-9 laid + OPV-6 Commiss.*			
	1-Jul				
2027	1-Jan	*OPV-10 laid + OPV-7 Commiss.*			
	1-Jul				
2028	1-Jan	*OPV-11 laid + OPV-8 Commiss.*			
	1-Jul				
2029	1-Jan	*OPV-12 laid + OPV-9 Commiss.*			
	1-Jul				
2030	1-Jan	*OPV-10 Commissioned*			
	1-Jul				
2031	1-Jan	*OPV-11 Commissioned*	*MHX-1 Keel laid*		
	1-Jul				
2032	1-Jan	*OPV-12 Commissioned*	*MHX-2 Keel laid*		
	1-Jul				
2033	1-Jan		*MHX-3 laid + MHX-1 Commiss.*		
	1-Jul		*HMAS Huon Decommissioned*		
2034	1-Jan		*MHX-4 laid + MHX-2 Commiss.*		
	1-Jul				
2035	1-Jan		*MHX-3 Commissioned*	*OHX-1 Keel laid*	
	1-Jul				
2036	1-Jan		*MHX-4 Commissioned*	*OHX-2 Keel laid*	
	1-Jul				
2037	1-Jan			*OHX-3 Keel laid + OHX-1 Commiss.*	
	1-Jul				
2038	1-Jan			*OHX-4 Keel laid + OHX-2 Commiss.*	
	1-Jul				
2039	1-Jan			*OHX-5 Keel laid + OHX-3 Commiss.*	
	1-Jul				
2040	1-Jan			*OHX-6 Keel laid + OHX-4 Commiss.*	
	1-Jul				
2041	1-Jan			*OHX-5 Commissioned*	*OPVX-1 Keel laid*
	1-Jul				
2042	1-Jan			*OHX-6 Commissioned*	*OPVX-2 Keel laid*
	1-Jul				
2043	1-Jan				*OPVX-3 Keel laid*
	1-Jul				
2044	1-Jan				*OPVX-4 Keel laid + OPVX-1 Commiss.*
	1-Jul				
2045	1-Jan	*OPV-1 Decommissioned*			*OPVX-5 Keel laid + OPVX-2 Commiss.*
	1-Jul				
2046	1-Jan				*OPVX-6 Keel laid + OPVX-3 Commiss.*
	1-Jul				
2047	1-Jan				*OPVX-7 Keel laid + OPVX-4 Commiss.*
	1-Jul				
2048	1-Jan				*OPVX-9 Keel laid + OPVX-5 Commiss.*
	1-Jul				
2049	1-Jan				*OPVX-10 Keel laid + OPVX-6 Commiss.*
	1-Jul				
2050	1-Jan				*OPVX-11 Keel laid + OPVX-7 Commiss.*
	1-Jul				

2.1.3. Submarine Production Line

In the case of submarines, a continuous-build production line will only be feasible if all 12 SEA1000 Future Submarines (FSM) remain in service for 24 years[xvi], and are delivered at 24 month intervals, assuming a construction period of 60 months[xvii] per boat.[51] Given that the first SEA1000 FSM must be delivered by the early 2030s, the lead SEA1000 boat (FSM-1) must be laid down by 2025 at the very latest (see Table 7).[52] This would deliver FSM-1 in early 2030, after which First-of-Class Trials (FOCT) would commence (see Table 7). Assuming that FOCTs go for all of 2030, and that no major flaws exist in the baseline SEA1000 design[xviii], FSM-1 could enter operational service in early 2032 (see Table 7).[53] On this timetable, FSM-12 would be commissioned in early 2052, and the lead FSM-1 would be decommissioned in early 2056, based on a service life of 24 years (see Tables 6 and 7 and 8). In order to sustain employment on the submarine production line and prevent a capability gap, the lead SEA1000 replacement boat (FSMX-1) would have to be laid down in early 2049 (see Tables 7 and 8).

The problem is that this methodology is slower than acquiring submarines from offshore shipyards, and would inflict a capability gap without preventative action. This is because the existing Collins Class submarines were originally intended to be decommissioned from 2024, after 28 years of service (see Table 5).[54] However, years of inadequate decision-making by two successive Australian Government's has meant that the Collins Class must undergo a Service Life Extension Plan (SLEP) to prevent a gap between the retirement of *HMAS Collins* and the commissioning of FSM-1 in 2030 (see Tables 5 and 6 and 7 and 8).[55]

[xvi] A service life of 24 years is essential since otherwise a work gap would emerge between the end of work on FSM-12 in early 2052 and the decommissioning of FSM-1 in 2056.

[xvii] 60 months is the assumed time it will take to build each SEA1000 FSM and is a fairly conservative estimate given that the SEA1000 FSMs will be considerably larger than the existing Collins Class, and Australian submarine workforces took an average of 85.92 months to complete each Collins Class submarine (across all six boats). The figure 60 months stems from the fact that the US Defense Industries can build larger and more complex Virginia Class submarines in around 60 months. 60 months is therefore assessed to be the Australian Department of Defence's target for the time to build each SEA1000 FSM.

[xviii] Numerous submarine programs across Australia and the United States have demonstrated that lead boats of new submarine classes frequently experience unexpected developmental issues. Consequently, it is highly unlikely that the SEA1000 FSMs will be delivered with zero design flaws or defects.

TABLE 5. COLLINS CLASS SUBMARINE SERVICE DATES			
Submarine Name	Commissioned	Original Decommissioning Date	Original Service Life
HMAS Collins	1996	2024	28 years
HMAS Farncomb	1998	2026	28 years
HMAS Waller	1999	2027	28 years
HMAS Dechaineux	2001	2029	28 years
HMAS Sheean	2001	2029	28 years
HMAS Rankin	2003	2031	28 years

Source: Commonwealth of Australia, Australia's Navy Today.[56]

TABLE 6. PROJECTED FUTURE SUBMARINE SERVICE DATES			
	First of Class Commissioning	First of Class Decommissioning	Anticipated Service Life
SEA1000 Future Submarine (FSM)	2030	2056	24 years
SEA1000 Replacement Submarine (FSMX)	2054	2080	24 years

TABLE 7. PROJECTED TIMELINE OF FUTURE SUBMARINES (2025-2055)

Start/Launch Date		SEA1000 Future Submarines (FSM) (60 month build)	SEA1000 Replacement Submarines (FSMX) (60 month build)
2025	1-Jan	FSM-1 Keel laid	
	1-Jul		
2026	1-Jan		
	1-Jul		
2027	1-Jan	FSM-2 Keel laid	
	1-Jul		
2028	1-Jan		
	1-Jul		
2029	1-Jan	FSM-3 Keel laid	
	1-Jul		
2030	1-Jan	FSM-1 Commissioned + FOCTs begin	
	1-Jul		
2031	1-Jan	FSM-4 Keel laid + FOCTs end & remedial work begins	
	1-Jul		
2032	1-Jan	FSM-2 Commissioned + FSM-1 enters active service	
	1-Jul		
2033	1-Jan	FSM-5 Keel laid	
	1-Jul		
2034	1-Jan	FSM-3 Commissioned	
	1-Jul		
2035	1-Jan	FSM-6 Keel laid	
	1-Jul		
2036	1-Jan	FSM-4 Commissioned	
	1-Jul		
2037	1-Jan	FSM-7 Keel laid	
	1-Jul		
2038	1-Jan	FSM-5 Commissioned	
	1-Jul		
2039	1-Jan	FSM-8 Keel laid	
	1-Jul		
2040	1-Jan	FSM-6 Commissioned	
	1-Jul		
2041	1-Jan	FSM-9 Keel laid	
	1-Jul		
2042	1-Jan	FSM-7 Commissioned	
	1-Jul		
2043	1-Jan	FSM-10 Keel laid	
	1-Jul		
2044	1-Jan	FSM-8 Commissioned	
	1-Jul		
2045	1-Jan	FSM-11 Keel laid	
	1-Jul		
2046	1-Jan	FSM-9 Commissioned	
	1-Jul		
2047	1-Jan	FSM-12 Keel laid	
	1-Jul		
2048	1-Jan	FSM-10 Commissioned	
	1-Jul		
2049	1-Jan		FSMX-1 Keel laid
	1-Jul		
2050	1-Jan	FSM-11 Commissioned	
	1-Jul		
2051	1-Jan		FSMX-2 Keel laid
	1-Jul		
2052	1-Jan	FSM-12 Commissioned	
	1-Jul		
2053	1-Jan		FSMX-3 Keel laid
	1-Jul		
2054	1-Jan		FSMX-1 Commissioned + FOCTs begin
	1-Jul		
2055	1-Jan		FSMX-4 Keel laid + FOCTs end & remedial work begins
	1-Jul		

TABLE 8. PROJECTED TIMELINE OF FUTURE SUBMARINES (2056-2082)

Start/Launch Date		SEA1000 Future Submarines (FSM) (60 month build)	SEA1000 Replacement Submarines (FSMX) (60 month build)
2056	1-Jan	FSM-1 Decommissioned	FSMX-2 Commissioned + FSMX-1 enters active service
	1-Jul		
2057	1-Jan		FSMX-5 Keel laid
	1-Jul		
2058	1-Jan	FSM-2 Decommissioned	FSMX-3 Commissioned
	1-Jul		
2059	1-Jan		FSMX-6 Keel laid
	1-Jul		
2060	1-Jan	FSM-3 Decommissioned	FSMX-4 Commissioned
	1-Jul		
2061	1-Jan		FSMX-7 Keel laid
	1-Jul		
2062	1-Jan	FSM-4 Decommissioned	FSMX-5 Commissioned
	1-Jul		
2063	1-Jan		FSMX-8 Keel laid
	1-Jul		
2064	1-Jan	FSM-5 Decommissioned	FSMX-6 Commissioned
	1-Jul		
2065	1-Jan		FSMX-9 Keel laid
	1-Jul		
2066	1-Jan	FSM-6 Decommissioned	FSMX-7 Commissioned
	1-Jul		
2067	1-Jan		FSMX-10 Keel laid
	1-Jul		
2068	1-Jan	FSM-7 Decommissioned	FSMX-8 Commissioned
	1-Jul		
2069	1-Jan		FSMX-11 Keel laid
	1-Jul		
2070	1-Jan	FSM-8 Decommissioned	FSMX-9 Commissioned
	1-Jul		
2071	1-Jan		FSMX-12 Keel laid
	1-Jul		
2072	1-Jan	FSM-9 Decommissioned	FSMX-10 Commissioned
	1-Jul		
2073	1-Jan		
	1-Jul		
2074	1-Jan	FSM-10 Decommissioned	FSMX-11 Commissioned
	1-Jul		
2075	1-Jan		
	1-Jul		
2076	1-Jan	FSM-11 Decommissioned	FSMX-12 Commissioned
	1-Jul		
2077	1-Jan		
	1-Jul		
2078	1-Jan	FSM-12 Decommissioned	
	1-Jul		
2079	1-Jan		
	1-Jul		
2080	1-Jan		FSMX-1 Decommissioned
	1-Jul		
2081	1-Jan		
	1-Jul		
2082	1-Jan		FSMX-2 Decommissioned
	1-Jul		

2.2 Criticisms of Australia's Naval Shipbuilding Policy

Since the Australian Government announced a permanent naval shipbuilding industry, various criticisms have been raised. Some criticisms have been motivated by ideological agendas, whereas others have been driven by logic. Three of the most logical and meritorious criticisms are listed below (see 2.2.1 and 2.2.2 and 2.2.3).

2.2.1. Criticism A: It's Just to Win Votes

With the 2016 Federal Election on 2 July the media has widely reported that the continuous naval shipbuilding policy is just about winning votes.[57] Given that 2016 could be a tight election it is possible that the continuous-build policy was partially aimed at solidifying electoral support in key shipbuilding states. However, it would be naïve to conclude that this is the Turnbull Government's only or principal justification, particularly given Prime Minister Turnbull's focus on renewed national security capabilities and a rejuvenated "21st century economy" (see 2.1).[58]

2.2.2. Criticism B: It's Cheaper to Buy Offshore

The media has made a significant issue over the fact that acquiring surface ships and submarines from offshore shipyards would be considerably cheaper.[59] Indeed, a 2015 RAND Corporation report found that building naval vessels in Australia is 30-40% more expensive over those built in offshore shipyards.[60] Although it is undeniable that a cost-premium does exist, for building in Australia, it is arguable that the flow-on benefits justify the additional cost, particularly if the permanent shipbuilding industry bolsters Australia's National Security and underpins Australia's transition to a "21st century economy" (see 2.1).[61]

2.2.3. Criticism C: It's Faster to Buy Offshore

The media has also reported that acquiring surface ships and submarines from offshore shipyards would be faster than building in Australia.[62] This theory is predicated on the fact that the work provided by a finite number of vessels would have to be evenly distributed over the intended vessels service-life, so as to provide a shipyard with sufficient work before a follow-on class commences. For instance, the RAN fleet will have 12 major surface combatants, three AWDs and nine Future Frigates. If we assume that the RAN intends to keep each major surface combatant in service for 24 years, a production line would have to

deliver one ship every two years to guarantee sufficient work. The problem is that such a process would deliver just six major surface combatants in 12 years, versus an offshore build that could feasibly deliver 12 major surface combatants over the same timeframe[xix].

However, as demonstrated in the previous section, the speed of naval vessel commissioning will vary considerably depending on the production line (see 2.1.1 and 2.1.2 and 2.1.3). Yet, it would be fair to assess that all three continuous production lines may be slower than acquiring surface ships or submarines from offshore shipyards.

2.2.4. Assessment of these Criticisms

Criticisms A, B and C are meritorious, and based on logical reasoning (see 2.2.1 and 2.2.2 and 2.2.3). However, the mindset driving such criticisms implies that Australia's journalists possess a limited understanding as to why Australia needs to build its submarines and surface ships in Australia. Ultimately, the Australian Government's continuous naval shipbuilding policy is not about winning votes, finding the cheapest solution or finding the fastest solution, but rather focussed on securing Australia's long-term National Security, as underpinned by a sustainable and capable naval shipbuilding industry.

The National Security justification for a permanent Australian naval shipbuilding industry is rarely, if at all, articulated by Australia's politicians and journalists. Consequently, the general public does not understand its pivotal role. In order to understand why Australia requires a permanent naval shipbuilding industry one must firstly understand the Australian Government's tri-layered national insurance policy.

[xix] Successful offshore shipyards make this feat possible by combining orders from their respective national navies and numerous overseas clients, thus eliminating the need to conserve the available work over a protracted period of time

3. AUSTRALIA'S TRI-LAYERED INSURANCE POLICY

The Australian Government has a national insurance policy that underwrites the ultimate security of Australian Citizens and Territories from any number of undesirable scenarios. Although there are many layers to the Australia's National Security, this paper has deliberately chosen to focus on three layers that are directly relevant to underwriting Australia's security from material threats. These three national insurance layers are: diplomacy, the ADF and Australia's naval shipbuilding industry (see 3.1 and 3.2 and 3.3).

3.1 Layer I: Diplomacy

Australia's Diplomats, as supported by the Department of Foreign Affairs and Trade (DFAT), are the Australian Government's first line of defence against threats to or violence directed against Australia's interests. Diplomats typically work out of Embassies, High Commissions and Consulates, providing a line of communication with critical stakeholders in their assigned countries or regions. One core objective of maintaining a diplomatic presence is to defuse hostile situations before escalation can occur.

Diplomatic negotiation will always be the Australian Government's preferred solution, since it has the potential to resolve 'transnational misunderstandings' at the least cost. In an ideal world all international disputes would be resolved through diplomatic negotiation. However, the world we live in is far from ideal and diplomacy does not always prevail.

Successful diplomatic negotiation requires all parties to participate in a reasonable and rational manner, as well as being willing to compromise, so that a solution can be reached that is acceptable to all parties. The problem is that state actors are not always reasonable, rational, cooperative and/or willing to compromise. This is partially due to the imperfections of human nature that afflict all world leaders, but is also due to the influence of political, religious or nationalist ideologies. Ideologies can make it politically untenable for a national leader to compromise. Consequently, diplomacy will not always be a feasible solution to international disputes.

The South China Sea (SCS) dispute is a perfect embodiment of this phenomenon. Several South East Asian nations claim sovereignty over sections of the SCS including: China, Taiwan,

Vietnam, the Philippines, Brunei, Indonesia and Malaysia.[63] These sovereignty disputes in the SCS have been in play for decades. In fact, as early as the 1930s the Chinese Government began to formulate its claims to almost the entire SCS.[64] In 1974 and 1988 China fought a brief war with Vietnam over various islands and reefs in the SCS.[65] In 1995 China militarily occupied the Spratly Islands.[66] In recent years, China has undertaken actions to escalate the situation with its neighbours, most notably the construction of artificial islands, aimed at fabricating the legitimacy of China's SCS claims.[67] The central problem to the SCS dispute is that the Chinese Government refuses to compromise, as would be required for successful bilateral or multilateral negotiations with other concerned parties.[68] Instead, the Chinese Government relentlessly repeats its demand of "indisputable sovereignty", over the entire SCS, whilst opposing multilateral negotiations in favour of bilateral negotiations.[69] The Chinese Government prefers bilateral negotiations so that it will be in the strongest position to induce and/or coerce the opposing party into a solution that distinctly favours China's interests.[70] The Chinese Government's current strategy is predicated on the assumption that other regional claimants will eventually capitulate to China's demands.[71] Ultimately, several decades of diplomatic negotiation have failed to resolve the SCS dispute, or reduce the temptation of claimants to escalate tensions through provocative and belligerent measures, thus demonstrating the inherent limitations of diplomacy.

Although the Australian Government would always prefer to resolve international disputes through diplomatic avenues, this will not always be possible, as evidenced by China's repeated refusal to engage in meaningful diplomatic negotiations, over the SCS dispute. Consequently, diplomacy will not always be able to prevent armed conflicts or crises, nor can diplomacy guarantee the protection of Australian Citizens and Territories from acts of aggression, by state or non-state entities. Therefore the Australian Government must possess additional protective and security options should diplomatic efforts not prevail.

3.2 Layer II: Australian Defence Force

The ADF is made up of three service branches: the Australian Army, the RAN and the Royal Australian Air Force (RAAF). All three branches provide the Australian Government with the capacity to respond to or neutralise threats that endanger the safety of Australian Citizens and Territories. In short, the ADF is the Australian Government's materiel insurance against any number of challenges and uncertainties that, if they ever materialised, would pose a grave threat to Australia's interests.[72]

The ADF is tasked with planning, training for and executing a wide range of protective duties at the behest of the Australian Government (see 3.2.1 to 3.2.7). These missions vary in terms of complexity, intensity, the threat posed to ADF assets and personnel, as well as the level of support required from each service (see Table 9).

3.2.1. Border Protection

Protecting Australia's borders involves executing Search and Rescue (SAR) operations, across 53 million square kilometres of maritime responsibility, maintaining the sovereignty of Australia's Exclusive Economic Zone, as well as protecting Australia's offshore territories and resources (see Table 9).[73]

3.2.2. Humanitarian and Disaster Relief

Countering the effects of disasters or humanitarian crises requires the ADF to be capable of transporting vast quantities of equipment, supplies and personnel around the world (see Table 9).[74]

3.2.3. Evacuation

The ADF can be tasked with evacuating Australian Citizens from unstable regions of Australia and/or from around the world (see Table 9).[75]

3.2.4. Stabilisation and Peacekeeping

The ADF can be tasked with helping to stabilise countries that may have plunged into chaos as a result of armed conflicts and/or natural disasters (see Table 9).[76]

3.2.5. Counter-Terrorism

The ADF provides Australian State and Territory law enforcement agencies with additional capabilities for responding to terrorist attacks (see Table 9).[77] This support is principally through the provision of Special Forces Tactical Assault Groups (TAG), specialists in hostage rescue missions.[78] But the ADF also supports national counter-terrorism efforts by providing additional layers of security for major public events, in addition to capabilities for responding to Chemical Biological Radiological Nuclear (CBRN) attacks.[79]

3.2.6. Counter-Piracy

The ADF contributes to multi-lateral efforts to counter pirates on the high seas (see Table 9).[80] The purpose of these efforts is to help ensure a secure maritime environment for seaborne trade, that is the lifeblood of the global economy.[81]

3.2.7. War-fighting

At the lowest end of the spectrum, the ADF contributes to UN or allied military operations, under a friendly air superiority umbrella and against adversaries that lack modern equipment or professional training, such as ADF operations in Afghanistan (see Table 9). In the middle of the spectrum, the ADF contributes to UN or allied military operations against moderately capable adversaries, for instance ADF contributions to the 1991 Gulf War (see Table 9). At the high end of the spectrum, the ADF may contribute to allied military operations against a highly sophisticated and technologically advanced adversary (see Table 9). Hypothetical allied Air-Sea Battle operations against China would fall under this category. The highest end of the war-fighting spectrum is a scenario in which the ADF would be required to independently defend Australian Territories from direct incursions by the air and naval forces of a hostile power (see Table 9).

TABLE 9. ADF MISSIONS AND SERVICE CONTRIBUTIONS	
Mission	ADF Service Contributions
3.2.1 Border Protection	***RAN:*** can provide surface ships (including patrol boats) to execute SAR operations and patrols of Australia's maritime periphery.
	RAAF: can provide aircraft for wide-area surveillance of Australia's maritime periphery.
3.2.2. Humanitarian & Disaster Relief	***RAN:*** can use its surface ships to transport large quantities of supplies, equipment and personnel as well as provide security for any forward-deployed ADF medical personnel. The RAN can also deploy Landing Helicopter Docks (LHD) to provide sophisticate hospital facilities in theatre and use embarked helicopters to deliver disaster relief supplies to isolated locations. ***RAAF:*** can use C-17 and C-130 airlift aircraft to deliver large quantities of supplies, equipment and ADF medical personnel into theatre. ***Army:*** can provide deployable medical units and security forces to protect RAN ships anchored close to shore. The Army can also provide additional utility helicopters to be transported into theatre via the LHDs.
3.2.3. Evacuation	***RAN:*** can provide surface ships to evacuate Australian Citizens by sea.
	RAAF: can provide C-17 and C-130 aircraft to evacuate Australian Citizens, particularly when time is a critical factor.
	Army: can provide troops to provide security for ADF evacuation efforts.
3.2.4. Stabilisation & Peacekeeping	***RAN:*** can provide surface ships to deploy, sustain and support land-forces ashore. ***RAAF:*** can provide aircraft to deploy, sustain and support land-forces. ***Army:*** can provide troops, vehicles and other land-based equipment as required to stabilise unsettled regions and secure the peace.
3.2.5. Counter-Terrorism	***RAN:*** can provide surface ships for maritime patrols to counter threats that come by sea. The RAN also provides Clearance Diver Teams (CDT) to directly combat terrorists in maritime environments.
	RAAF: can provide fixed-wing aircraft to transport ADF personnel, equipment and supplies as necessary.
	Army: can provide Special Forces TAGs to assist police forces in neutralising terrorists and any CBRN devices that they may be carrying.
3.2.6. Counter-Piracy	***RAN:*** can provide surface ships to deter, detect and neutralise pirate threats on the high seas. ***RAAF:*** can provide wide-area surveillance coverage of the high seas and vector in RAN assets to assist ships in distress. ***Army:*** can provide troops to assist countries with port security.
3.2.7. War-fighting	***RAN:*** can provide surface ships and submarines to deter, detect and neutralise incursions by hostile forces that pose a threat to Australia's security. The RAN can also use its LHD sealift capabilities to deliver, sustain and support ADF forces in distant theatres.
	RAAF: can provide combat aircraft for air support to ADF and allied land forces in benign or contested high-threat airspace environments. The RAAF can strike at hostile submarines or ships, as well as provide persistent surveillance of Australia's air and maritime approaches.
	Army: can provide land forces for deployment into distant theatres, as well as land-based anti-air and anti-ship missile batteries to defend Australian Territories from hostile incursions.

3.3 Layer III: Naval Shipbuilding Industries

Australia's naval shipbuilding industry is the third layer of the Australian Government's insurance policy, and provides sovereign control over the RAN's submarine and surface ship capabilities. Sovereign control extends beyond the crewing and operation of navy vessels to encompass the way they are delivered. Sovereign control over critical naval capabilities is advantageous for two reasons (see 3.3.1 and 3.3.2)

3.3.1. Flexibility

If Australia's strategic outlook were to worsen considerably it would be possible for the Australian Government, with active naval shipbuilding production lines, to expand the RAN surface ship and submarine fleets.[82] In fact, the 2009 DWP hinted at this prospect and the 2013 Department of Defence Future Industry Skills Plan explicitly stated this intention.[83]

Rapidly expanding the RAN could be accomplished with as little as five years notice. It would involve laying additional keels at the rear of all relevant submarine and surface ship production lines. It would also require accelerating the completion of all naval vessels under current construction. The overall result would be the accelerated delivery of naval vessels. However, such an ambitious naval expansion program would likely require significant additional funding, in addition to the following advanced preparations by the Australian Department of Defence:

- Plans to expand shipyard workforces
- Plans to lay additional submarine or surface ship keels
- Plans to accelerate the completion of naval vessels currently under construction
- Stockpiling all ship or submarine components not manufactured in Australia[xx]
- Plans to shorten naval test, evaluation and sea trial processes
- Plans to shorten the training of naval officers and sailors

[xx] Includes combat systems, weapons systems, sensors, integration components, electronics, software, support materials, support equipment.

3.3.2. Security

Another problem with building submarines or surface ships in offshore shipyards is that it could provide third-party foreign intelligence agencies[xxi] with the greatest opportunity to gain unauthorised access to the vessels design or the vessel themselves. Conversely, building all submarines and surface ships in Australian shipyards would provide the greatest protection for sensitive information regarding the vessels technologies, specifications and capabilities.[84] This is because, in Australian shipyards, Australian counter-intelligence agencies have the maximum jurisdictional purview to impose and assure the rigorous enforcement of measures to safeguard access, both physical and digital, to the vessels plus all other sensitive information.

Furthermore, building all RAN submarines and surface ships domestically would enable Australian counter-intelligence to extraneously vet and monitor all personnel and contractors with access to sensitive information. For instance, Australian agencies could monitor all shipyard personnel and contractors with access to highly-classified Sensitive Compartmentalised Information (SCI), when at work and during off-duty hours. This would be particularly valuable for helping to assure that personnel with intimate and highly classified information access are not cultivated as assets by foreign intelligence operatives.

[xxi] **Third Party Foreign Intelligence Agencies:** foreign intelligence agencies that are not of the client nation or the nation in which the offshore shipyard is located.

3.4 Assessing Australia's National Insurance Policy

The reality is that all three layers of the Australian Government's national insurance policy are required. Diplomacy is required to prevent and de-escalate crises or conflicts. The ADF is required to deter and, if necessary, insulate Australian interests from any number of undesirable scenarios. Furthermore, Australia's naval shipbuilding industry is required to provide the Australian Government with flexible and secure naval capabilities. Neglecting any of these insurance layers would be just as illogical as arguing for Fire Brigades to be disbanded simply because ones house has not had a fire in 70 years.

CONCLUDING ASSESSMENTS

It is often forgotten that Australia is the largest island-continent worldwide, and relies on unimpeded maritime access to interface with the global economy. This is particularly the case since over 99% of all Australian exports are transported by sea.[85] In order to ensure unimpeded access, Australia requires a flexible and high-capability ADF that can credibly protect Australia's maritime interests.

The most critical enabler of a flexible and maritime capable ADF is the indefinite sustainment of an Australian naval shipbuilding industry, with submarine and surface ship production lines. Not only does this industry provide the greatest level of surety against unauthorised access by foreign intelligence services, but also provides the Australian Government with the option of expanding the RAN should strategic circumstances warrant it. The bottom line is that the continuous naval shipbuilding policy of the Turnbull Government will give future Australian Government's the greatest flexibility over how, when and in what numbers it is able to supply the RAN with critical surface and undersea capabilities.

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