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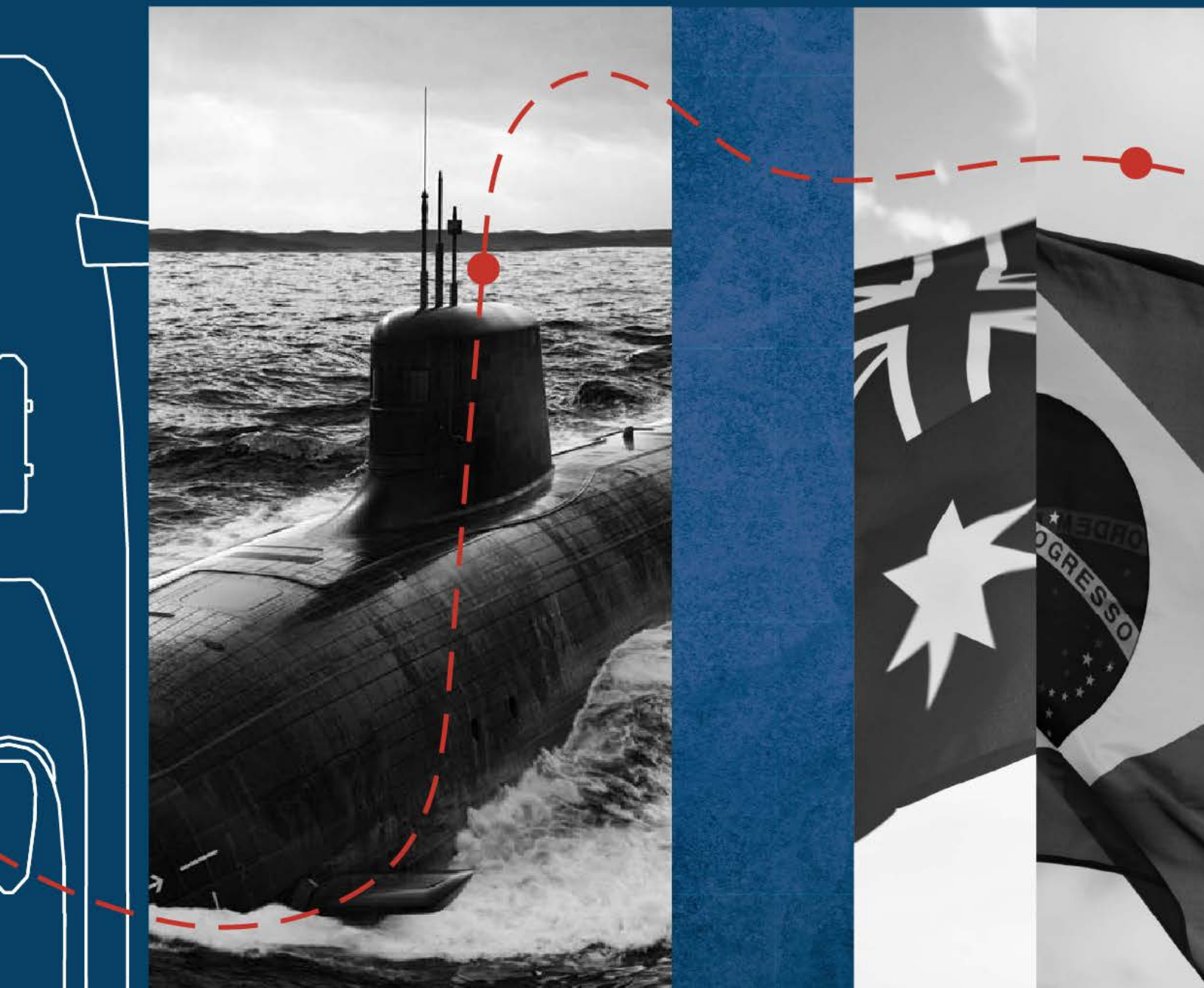
Navigating Responsible Stewardship of Nuclear-Powered Submarines

Jamie Kwong and Toby Dalton, editors



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Preface

Corey Hinderstein

Whether for civilian reactors or military applications, demonstrating that nuclear technology is being handled responsibly and safely is critical for public support and international peace and security alike. As geopolitical and technological shifts spur new nuclear projects, both the difficulty and importance of effective assurances will only increase.

The pursuit of naval nuclear propulsion by states without nuclear weapons presents a host of new assurance challenges. As the first such states set to acquire conventionally armed, nuclear-powered attack submarines, Australia and Brazil are tackling these challenges head on. They must demonstrate their nonproliferation bona fides to the international community, including by working closely with the International Atomic Energy Agency to meet their safeguards commitments in new ways. They must engage with states in their regions to instill confidence in their abilities to safely and securely operate the nuclear-powered vessels in regional waters. Finally, they must assure domestic audiences that these massive defense procurements are a sound investment that will be regulated and managed effectively and safely. How Canberra and Brasília address these challenges will establish precedents for other, future operators of nuclear-powered submarines and perhaps other, future uses of advanced nuclear technology, such as floating nuclear power plants.

This compilation identifies and unpacks key issues Australia and Brazil are navigating in trying to meet these confidence-building requirements and establish their credentials as responsible stewards of naval nuclear propulsion. Drawing on a range of expertise and perspectives from Australia, Brazil, and beyond, it considers various strategic, legal, normative, regulatory, and social dimensions of these issues. In so doing, expert authors offer insight into how Australia, Brazil, and other potential, future operators can build international, regional, and domestic confidence in their naval nuclear programs. I hope you find the volume an informative, useful, and thought-provoking exploration of a growing trend toward nontraditional applications of nuclear technology.

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From Australia to Brazil: Naval Nuclear Propulsion and Responsible Nuclear Stewardship

Jamie Kwong and Toby Dalton

Navigating New Waters

Australia and Brazil are poised to become the first states without nuclear weapons to put conventionally armed, nuclear-powered attack submarines (SSNs) to sea. Until now, the operation of nuclear-powered submarines, including SSNs as well as submarines equipped with nuclear weapons (SSBNs), has been reserved to nuclear-armed states. While neither Australia nor Brazil is pursuing SSBNs—both remain committed to not developing nuclear weapons—the pursuit of SSNs by non-nuclear states nonetheless raises a range of novel political, technical, and social questions. It is important for both governments and others to think through these questions and to develop clear and robust ways to manage the associated challenges before the boats enter the water.

Australia is acquiring SSNs through its AUKUS partnership with the United Kingdom and United States. As part of a phased approach, Canberra plans to first purchase a number of U.S. Virginia-class SSNs in the early 2030s before developing SSN-AUKUS submarines in conjunction with its partners and deploying those submarines in the 2040s. The United States and United Kingdom will provide Australia with complete, welded units of highly enriched uranium (HEU) to fuel the submarines' reactors. Using HEU means there will be no need for refueling during the service lives of the boats.

Meanwhile, Brazil is developing an indigenous nuclear reactor for its SSN fleet, though France is assisting with the non-nuclear components of the submarine design. The Brazilian Navy owns and operates the country's uranium enrichment program, which it will use to provide low-enriched uranium to fuel the submarines. The submarine design will require the reactors to be refueled several times to prolong the service lives of the boats. The Navy plans to deliver the first SSN in the late 2030s.

Even while their programs differ in these notable respects, Australia and Brazil are traversing similar issues in developing, institutionalizing, and operationalizing SSNs at the same time, raising important questions about the broader implications of their SSN programs.

Why are Australia and Brazil seeking SSNs in the first place? The two countries are situated in very distinct geostrategic contexts, yet both see the need for this advanced capability that, compared to the diesel submarines they currently operate, will afford them perceived military advantages such as greater range and stealth. Both countries publicly identify a deterrence mission for their SSN programs, but what will this mean in practice? How will they address the potential strategic impacts of these systems, including concerns by regional partners and reactions by adversaries? Should the governments consider additional reassurance measures?

> **Even while their programs differ . . . Australia and Brazil are traversing similar issues in developing, institutionalizing, and operationalizing SSNs.**

What approaches are Australia and Brazil taking to assure international and domestic audiences about nonproliferation, safety, and security? Are there risks that these programs could create precedents that could be used by other states as a cover for nuclear weapons activities? Are there decisions, actions, or behaviors that Australia and Brazil could adopt to prevent this? What are the risks inherent in the two countries' different approaches to fueling their submarines? Both countries are undergoing yearslong negotiations with the International Atomic Energy Agency (IAEA) to establish special procedures for verifying that the nuclear material used to fuel the submarines will not be diverted to illicit nuclear weapons activities. What do these separate processes indicate about best practices for achieving transparency and meeting verification requirements? Could these efforts establish norms or precedents for naval nuclear propulsion and perhaps also other future, nontraditional applications of nuclear technology?

Until now, SSNs have largely operated outside of traditional nuclear governance mechanisms because they have been a capability deployed only by nuclear-armed states. In addition to IAEA safeguards, should SSN programs by non-nuclear states be addressed in other international regimes? For instance, should the Convention on Nuclear Safety be amended to cover such programs? Given their potential to blur the lines between the use of nuclear technology for legitimate military purposes and illicit weapons purposes, do the programs align with nonproliferation norms? And how will Australia's and Brazil's SSN programs be situated in their respective nuclear-weapon-free zones? The free-zone issue in particular raises a number of normative, legal, procedural, and technical matters, which are explored more deeply in a companion volume to this publication.

How are both countries planning to manage the long-term financial, human capital, and technological requirements of their SSN programs? What challenges will they face in sustaining these multigenerational programs through inevitable political and social changes? How will they establish and meet robust regulatory requirements, including balancing between civil and military oversight of the programs? How can they build social licenses to secure ongoing public support and buy-in? While both have leaned into economic and industrial development narratives, can they bring along local communities and oft-neglected voices from impacted communities where safety and environmental concerns are of the utmost importance? All of these factors are central to the responsible conduct of these programs.

Credentials of Responsible Stewardship

To more deeply examine these issues, researchers at the Carnegie Endowment for International Peace, in partnership with colleagues at the Australian National University, Pontifical Catholic University of Rio de Janeiro, and State University of Rio de Janeiro, convened an expert dialogue on the global dimensions of naval nuclear propulsion.

In bringing together Australian, Brazilian, and international technical, policy, and legal experts, we put the Australian and Brazilian SSN programs in dialogue to increase mutual understanding of the challenges involved in safely and securely operating SSN programs and to facilitate an exchange of ideas on how to build national, regional, and international confidence in both programs.

In doing so, we aimed to encourage the development of a framework for the responsible stewardship of naval nuclear propulsion by non-nuclear states—one that could apply not only to Australia and Brazil but also to future states that may seek to develop SSN capabilities. The goal was not to develop a generic, prescriptive framework, not least because there is no established best practice. Rather, the goal was for the framework to be informed by Australian and Brazilian efforts to demonstrate their commitments to responsible stewardship to date, which implicitly recognize that SSN programs are different from other civil nuclear activities and that using nuclear technology for military purposes carries with it the need to take additional actions. These efforts create expectations for how Australia's and Brazil's programs should each be implemented, how future states would (or should) act, and how choices and behaviors around these programs might relate to additional nontraditional applications of nuclear technology.

The notion of "credentials" offers one way to think about the various elements of responsible stewardship. Such credentials, or attributes of responsible stewardship, could be tailored to the specific context of a particular state's SSN program even while promoting common elements across programs, such as robust and transparent dialogue with the IAEA. For example, membership in a nuclear-weapon-free zone treaty; technical choices within a program that aim to minimize proliferation risks; and advanced preparations for the entire life cycle of an SSN program, including waste disposal, could all be considered important credentials of responsible stewardship of naval nuclear propulsion.

The credentials concept leaves open some important questions, including how the international community as well as domestic constituencies can best hold states accountable for pursuing such credentials in developing SSN programs. But it nevertheless offers a potentially useful framework for creating expectations around responsible stewardship, while recognizing the inherent differences between the Australian, Brazilian, and any future SSN programs.

The Compilation's Chapters

The following chapters explore several areas and dimensions where Australia and Brazil are or could be establishing their credentials as responsible stewards of SSNs. The chapters build on discussions in the project dialogues and capture important Australian, Brazilian, and international perspectives.

Stephan Frühling begins by asserting that despite substantial differences in Australia's and Brazil's programs, they have the same fundamental strategic rationale: securing the capability to fight for sea control in great ocean basins. Both states have struggled, however, to effectively articulate this rationale, exacerbating the challenge of addressing both international and domestic concerns about their programs.

Benjamin Zala argues that the Australian discussion around the deterrence mission of its SSNs is missing consideration of how Australia can reassure its adversaries of its defensive intentions. Especially given the potential threat that China might perceive from Australia's SSNs to its SSBNs, Canberra must find creative solutions to its SSN reassurance problem—or else risk undermining, rather than reinforcing, deterrence.

Layla Dawood explains the Brazilian deterrence mission, where SSNs will serve as a key defensive tool for deterring extraregional threats posed to Brazil's vital interests in the South Atlantic. She argues that the development and bureaucratic narratives and history baked into the SSN program serve as a reassurance in and of themselves of the defensive nature of the program.

James Casterton offers a detailed overview of the international safeguards procedures, questions, and challenges raised by Australia's and Brazil's naval nuclear propulsion programs. He contends that while there is no one-size-fits-all safeguards approach, both countries, along with the IAEA, must adopt an approach centered on transparency to ensure that the international safeguards system remains viable in the face of evolving nuclear activities.

Australia's and Brazil's SSN programs occupy a normative gap in nuclear governance, Monica Herz asserts, a governance challenge only exacerbated by the erosion of multilateral and nuclear norms in the broader international system. Despite these challenges, Australia and Brazil have an opportunity to be norm entrepreneurs, to set expectations around transparency and trust-building for future nonproscribed and nontraditional uses of nuclear technology.

Veronica L. Taylor explores the concept of responsible nuclear stewardship in the context of the Australian approach to regulation. She argues that examining Australia's regulatory approach, including the ways in which it encapsulates transparency and engagement beyond minimum legal requirements, offers a useful way to conceptualize responsible stewardship for naval nuclear propulsion—and perhaps also other future uses of nuclear material—by non-nuclear states.

Drawing on his experience in the UK Royal Navy, Mike Wareham introduces the concept of a social license and highlights the critical importance of securing ongoing approval and support for submarine programs by the public. He points to the UK example in identifying successful approaches for and key challenges to building a social license.

Mariana Nascimento Plum examines the challenges Brazil faces in building a social license for its dual-track nuclear program, which includes both civil power applications as well as the SSN program, amid a rapidly shifting nuclear landscape. She argues that Brazil has taken important steps in promoting the strategic autonomy and technical ambitions of the program but needs to balance those efforts with environmental stewardship and social inclusion.

Finally, Art Cotterell concludes by critiquing the very concept of a social license, arguing that the ambiguities around whose voices matter in building approval and support for Australia's SSN program can problematically exclude key communities, including those who might be most directly impacted by the program. He contends that Australia must do more to foster genuine, public discussion or else risk eroding public trust.

02

Nuclear Order at Sea? Strategic Rationales and Unintended Implications of Australia's and Brazil's Nuclear Powered Submarine Programs

Stephan Frühling

Brazil and Australia are set to become the first members of a new club of countries that will operate SSNs without also possessing nuclear weapons. Most international concerns about both countries' nuclear propulsion programs focus on how they will be managed under the comprehensive safeguards agreements each country maintains with the IAEA, as required under the Nuclear Non-Proliferation Treaty (NPT). But the fact that SSN technology has so far only been available to and used by nuclear-armed states is a second, less obvious link between both countries' submarine programs and the wider nuclear order.

This chapter argues that, for all their differences, Brazil and Australia share strategic traits that are rooted in their geographic positions. These traits make SSNs particularly relevant for both countries, even if they have struggled to advance a coherent strategic rationale along these lines. These traits may also help establish the strategic bona fides of any future aspirants to the technology. But the historical association between SSNs and nuclear weapons states operating ballistic missile submarines armed with nuclear weapons is also real. However spurious in practice, sui generis arguments that the new club may affect the wider nuclear order beyond nonproliferation concerns will be part of domestic and international arguments about the unintended consequences of the Brazilian and Australian SSN programs.

Two Countries United by Their Differences?

On the surface, Brazil's and Australia's strategic circumstances, and the paths they are each taking to achieve their respective SSN aspirations, could not be more different.

Brazil's program is now in its fifth decade. With its focus on developing and controlling the whole nuclear fuel cycle, the program is part of an industrial policy narrative of state-led development through the fostering of national, sovereign industry. Proudly nonaligned in geopolitical terms, Brazil's program is neither embedded in narratives of alliance and collective defense nor intended to respond to any appreciable strategic threat in the South Atlantic. It has caused few regional ripples, not least because Brazil towers in demographic, economic, and military terms over its neighbors, including its historic rival Argentina. In technological terms, the program's low-enriched reactor design aligns with the recommendations of many nonproliferation advocates, who promote the global phasing out of HEU reactors, even as the military use of these materials still raises thorny safeguards challenges.

In contrast, Australia's SSN program began with a surprise announcement by the leaders of Australia, the United Kingdom, and the United States in 2021. Its strategic rationale and realization are inseparable from Australia's alliances with both of these partners (informal with the UK, treaty-based with the United States). Although it is a capability acquisition program at its core, AUKUS is embedded in narratives of, and preparation for, collective defense. It is part of Australia's strategic adaptation to a possible threat from China, which has strongly criticized the program as embodying "Cold War thinking." According to the AUKUS implementation plan, Australia will develop the capacity and expertise to eventually operate its own SSNs by first hosting and jointly supporting U.S. and UK SSNs on its territory. It will then seek to maintain its own boats in country, though it has no aspiration to become independent of its allies in relation to the technology and industry required to master the nuclear fuel cycle. Reliance on U.S. and UK reactor technology means that Australian SSNs will be powered by HEU. The transfer of HEU from a nuclear-armed state to a non-weapons state has spurred the program's critics, including China and nonproliferation advocates, to raise normative objections, even though the delivery of HEU in the form of welded power units for the reactors means the material poses fewer specific safeguards diversion or proliferation risks.

Indeed, a conclusion from surveying key aspects of both programs could be that their only similarity seems to be that they are equally perplexing and quixotic quests! And yet, the fact remains that, as different as they are, Brazil and Australia are the only non-nuclear weapon states embarking on these multigenerational projects and establishing a new category of states in the global nuclear order that are using nuclear technology for military purposes, without seeking nuclear weapons. There is thus more underlying similarity between the two in terms of motivations, challenges, and explanations than the differences in their approaches to the technology suggest.

SSNs and the Fight for Sea Control in the Great Ocean Basins

For over a century, there has been an active international trade in conventional submarines, which has enabled about four dozen countries to operate them and about a dozen to build them. Conventional submarines are an expensive but quite standard military capability for

many countries that have substantive coastlines to defend. Equipped with heavy torpedoes, they are a formidable capability, an ideal ambush predator that can lurk in natural chokepoints and thrive in confined, shallow bodies of water (for example, the Baltic Sea). However, these vessels are limited in their endurance, speed, and availability of power to operate large-sized sensors, as well as by their need to snorkel to recharge their batteries, with noisy diesel engines. They are unable to move great distances under threat and are too slow to keep up with either surface vessels or their nuclear-powered cousins.

Nuclear propulsion overcomes these inherent limitations and enables submarines to operate in large ocean basins. It provides enduring stealth and submerged speed that exceeds that of many surface vessels, both in operational and tactical contexts. Rather than merely lurking, an SSN can be an active hunter that can chase its prey. The emergence of nuclear-powered submarines in the late 1950s thus signaled a new era for blue-water navies. SSNs have become core to the battle for sea control in wide ocean basins where the best defense against an adversary's nuclear-powered submarine is often one's own SSN—especially if it can tail the adversary undetected in a permanent, peacetime game of cat-and-mouse.

Only a small circle of countries, however, have built SSNs for the fight over oceanic sea control—the United States, the Soviet Union, and, to some extent, the United Kingdom.[1] Very few countries have both the strategic motivation and the financial and industrial resources to do so even today. For many coastal countries, even conventional submarines are out of reach or deemed unnecessary for defense. For others, shallow coastal seas and archipelagic environments—and, for some in Northeast Asia and Europe, their alliance with the United States—make conventional submarines perfectly adequate to keep threats from approaching their shores.

That said, the ability of a submarine with nuclear propulsion to remain submerged almost indefinitely also led to the development of the SSBN as a platform promising a secure nuclear second-strike capability. In other words, mastery of nuclear submarine propulsion became an ancillary technology essential for what was considered a fully-fledged, survivable nuclear arsenal. During the Cold War, all five recognized nuclear powers therefore proceeded in developing nuclear submarine programs. India has since done the same, leasing Russian SSNs and developing their own SSBNs, thus maintaining the close alignment of nuclear submarine propulsion with nuclear-armed states. This close association of SSNs as an enabling technology for SSBNs, and the potential that an SSN program might be used as cover for a clandestine nuclear weapons program, make the development of SSNs by non-weapons states a clear nonproliferation concern.

A Shared, if Unarticulated, Strategic Rationale

In this context, Brazil and Australia are thus distinct outliers that break the historically neat overlap between nuclear-armed states and those operating SSNs. If one considers the original rationale for having an SSN as having the capability to fight for sea control in

great ocean basins, however, their interest is less surprising, and both countries are more similar than they might seem. Neither faces a significant threat on land, which means that an aggressor would have to cross the sea; both countries directly border great ocean basins, lacking natural chokepoints for forestalling an aggressor's approach. Both countries' major cities are on their coastlines, and both are major resource exporters heavily dependent on seaborne trade. Brazil does not have any security alliances with other countries, and its inability to defend itself against the predations of German submarines dragged it into the European war in 1942 and remains an important aspect of its strategic memory. And while the United States and Australia are close allies, the latter has for a long time sought defense "self-reliance," knowing that the defense of its remote continent is of limited priority for its major ally.

In that sense, it is far less likely that Brazil and Australia are harbingers of a new wave of states pursuing SSNs than that they are two geostrategic edge cases that happen to have both the motivations and opportunities to acquire SSNs that are shared by few, if any, other countries.[2] Certainly, the geostrategic factors in common among Australia and Brazil—strong seaborne trade dependence, lack of a land or other proximate military threat, direct access to deep ocean basins with no natural chokepoints, and the practical need for self-reliance in defense matters—would be a useful starting point to establish objective criteria for a genuine strategic rationale for an SSN program in a non-nuclear country. These criteria could, for example, help to distinguish between programs based on clearly articulated defense needs and those that might instead merely serve as a cover for more sinister nuclear weapons proliferation purposes.

However, both Australia and Brazil have struggled to articulate strategic rationales for their programs. In Australia, officials tend to take refuge in arguments about unique requirements of range. These arguments, however, mirror the arguments made for the previous, conventional submarine program.[3] Perhaps consequently, public support for acquiring nuclear submarines remains roughly two-to-one in favor, but it is slowly declining. In Brazil, the British success in the 1982 Falklands War reinforced for the Navy the importance of blue-water capabilities. But today, the SSN program is framed as part of a broader, less focused naval modernization effort to protect the resource-rich coastal waters that Brazil calls the Blue Amazon.

> **Both Australia and Brazil have struggled to articulate strategic rationales for their programs.**

In both countries, the governments have not effectively made a case for the SSN as a specific and special military capability to defend against a threat that remains very abstract in Brazil's case and that most people in either country still find difficult to conceive of. Instead, in both Brazil and Australia, broader economic and industrial policy arguments, however spurious from a cost-effectiveness point of view, are left to do a lot of the political heavy lifting. Indeed, to anyone outside the very small group of professionals with an active

interest in the naval technology of the great powers in the second half of the twentieth century, an SSN program without nuclear weapons must seem simply a more expensive and indulgent version of conventional submarines that could be acquired much cheaper from the international market.

For many countries, even conventional submarines can seem like an indulgence of marginal benefit. The even greater cost, even greater industrial complexity, even longer timelines, and, even if marginal, still nonzero safety risk involved in naval nuclear propulsion programs make sustaining domestic support for acquiring SSNs an even greater challenge in the absence of an immediate, obvious threat. Nor can Brazil and Australia justify the cost of their SSN programs as necessary, secondary aspects of their statuses as independent nuclear weapons powers in the way that Britain and France do. SSNs and nuclear weapons have in common that they can only be acquired with very long lead times and are geared toward meeting possible great power threats that may or may not arise. There is no doubt, though, that explaining the relevance and role of nuclear weapons for long-term, existential security is a more straightforward case to make, even in abstract terms, than the case that Brazil and Australia have to make for their SSNs.

Unlikely Associates for the Long Term

But it is not just domestically that the nature of this capability raises questions that Brazil and Australia find hard to grapple with. In practice, with the exception of nuclear-armed states, the military reach of almost all countries is primarily local. The acquisition of SSNs would place Brazil and Australia into a category of their own, where they would have the ability inherent in their submarine force to operate far beyond their coastal and even regional waters. This raises questions of intention and reassurance that they did not have to face before—questions that those politically opposed to the SSN programs, either domestically or internationally, are only too happy to raise.

SSNs remain the main—and largely only—means to hold nuclear countries' SSBNs at risk. Australia and Brazil will therefore be operating capabilities that can, at least in theory, hold at risk nuclear forces—a genuinely exclusive club that will attract, at minimum, international attention to their capabilities they would not otherwise face. If there will one day be a new era of arms control, Brazil and Australia may well find themselves included in that group of countries that can affect global strategic stability, even more so if the club they have established grows to include additional countries. At the same time, once they actually join the exclusive club of SSN operators, they will also find new shared interests with the existing nuclear-armed operators of such submarines: Any nuclear accident with international repercussions would make it harder for all of them to gain the international license required for operating their SSNs in foreign waters and ports, if not to maintain the domestic license to operate them at all.

Neither Brazil nor Australia played any role in the decision of the other to embark on its respective SSN program. The countries have taken opposite choices in almost every aspect of how to achieve this capability. Yet even as neither country's SSN program speaks to any particular interest in affecting wider nuclear balances, both now, and will for the long term, find themselves in the same boat, and will have to manage the many underlying challenges of finding a new place for themselves in the wider debates on international nuclear order and strategic stability.

03

AUKUS and the Importance of Reassurance

Benjamin Zala

SSNs will provide Australia with a significant upgrade in its ability to project force in its immediate region. It is central to what Australia's Deputy Prime Minister and Defence Minister Richard Marles in April 2024 described as the country's aspiration to achieve "impactful projection" with its armed forces. All states come up with such euphemistic phrases to describe the lethality of their defense capabilities, but Marles's remarks imply that an SSN capability gives Australia a greater ability to hold its adversary's surface and underwater vessels at risk, even at some distance from Australia's territorial waters. Doing so, according to Prime Minister Anthony Albanese's government, is key to deterring threats to Australian interests.

While the putative deterrence benefits of SSNs have featured strongly in Australian discussions about AUKUS, so far the lion's share of this discussion has been devoted to only half of the task of deterrence: making threats. Largely absent from AUKUS discourse has been a focus on the other half of the equation: reassuring the recipient of your deterrent threats that your intentions are limited to defending yourself.

> **Largely absent from AUKUS discourse has been a focus on the other half of the equation: reassuring the recipient of your deterrent threats that your intentions are limited to defending yourself.**

That is not to say reassurance is missing from Australian deterrence discussions entirely. Australia's 2024 National Defence Strategy (NDS) discusses the need for other countries in the region, apparently referencing China, to match upgrades in defense capabilities with reassurances of their defensive intentions. It states, "Countries in the Indo-Pacific are investing in new and sophisticated weapons. These weapons are frequently characterised by greater range and speed and are increasingly difficult to counter." The NDS notes that "it is natural for countries to seek to modernise their armed forces and keep pace with technology"; however, it adds that "it is vital for stability and to minimise tensions that such modernisation is accompanied by transparency and strategic reassurance."

While presumably describing defense developments outside of Australia, launching a capability with "greater range and speed" that is "increasingly difficult to counter" is an almost perfect description of Australia's own SSN ambitions. In other words, this call for greater transparency and assurance goes for Australia as much as anyone else in the region.

Yet, there has been hardly any public discussion—and presumably little in private, as well—in Australia about this aspect of the AUKUS project. In order for this major upgrade in Australia's naval capabilities to act as a successful deterrent, Canberra has no choice but to find ways to effectively reassure adversaries of its defensive intentions.

Deterrence: Threats Plus Reassurances

Deterrence is achieved by carefully matching two things: threats and reassurances. Despite the popular idea that deterrence is only about making threats, a successful deterrence policy requires both crucial ingredients in every situation. The same capability can be used for both offensive and defensive reasons and therefore the threat of use must be limited. As Thomas C. Schelling famously wrote, "To say, 'One more step and I shoot,' can be a deterrent threat only if accompanied by the implicit assurance, 'And if you stop I won't.'" This applies to both deterrence by punishment (where an adversary faces an assured retaliation if they attack first) as well as deterrence by denial (where an adversary is convinced that an attack is too hard or costly to undertake successfully).

If Australia's SSNs will be put toward a deterrence by denial strategy, as has been outlined in government statements such as the NDS, then this strategy will require finding ways to reassure a potential attacker not only that their attack will be unlikely to succeed but also that withholding an attack will not cause them greater problems in the long run. As Michael J. Mazarr puts it, "The goal of dissuasion is to convince a potential attacker that the cost-benefit calculus of aggression is unfavorable, partly through emphasizing the costs of aggression but also through offering reassurances and benefits that make a world without aggression more attractive."

The deterrence by denial strategy rests on the assumption that all potential adversaries will believe that Australian intentions will remain peaceful and fundamentally defensive in the future. And yet, given the increased range over which its submarines will be able to operate, as well as the increased lethality and range of the missiles aboard each vessel, Australian SSNs will be able to more effectively target the forces of adversaries far from its shores. Such targets could include anything from Chinese or even Indian SSBNs and the submarine bases that would serve them during a future conflict—a task assigned to SSNs by other states—or even the conventional air and naval forces of other future military powers in Asia.

Canberra's reassurance strategies must therefore be highly credible given how capable these vessels will be. In the immediate future, this will be relatively easy with a state, such as India, that is unlikely to have reason to be concerned about the range of Australian SSNs. But in relation to China in the coming years, reassurance is likely to be much more difficult.

And over the longer term, as the region becomes increasingly contested, it will remain an inherently difficult task because while a capability itself does not change, intentions can. Australia may not intend to target Chinese SSBNs today, but its ability to do so tomorrow is equally as important from a Chinese perspective. The changes in Australia's own decisionmaking on its future submarine program over the past few years are a reminder that states' intentions do indeed change, such that reassurances made today may not hold in the future.

> **Canberra's reassurance strategies must be highly credible given how capable these vessels will be.**

If instead Australia's SSNs are used in a future deterrence by punishment strategy, the recipient of the deterrent threat posed by the SSNs must be reassured that this threat is contingent upon their behavior. Without reassurance of Canberra's defensive intentions, such a threat is simply a promise of aggression no matter what they do. For example, in a conflict involving an adversary with a vulnerable SSBN fleet (for instance, China), Australia's SSNs may be viewed by an adversary as a potential first-strike threat. It is only the credible reassurance that this threat would be a punitive reprisal rather than preventive that would keep an adversary from landing the first blow in self-defense. As Thomas J. Christensen puts it, "unless the target believes a punitive attack is contingent on its own behavior, it has no incentive to comply with the deterrer's demands."

In this regard, Australia's defense minister has stated that the role of the SSNs will be, "by virtue of their stealth and the unique capabilities," to "place the single biggest question mark in our adversaries mind." By this he means placing a question mark over whether attacking Australia could result in reprisals that would cause unbearable damage. But that question mark can extend to other things too, such as what other, perhaps less defensive, purposes these SSNs could be put toward at some point in the future—particularly during a crisis.

The Geography of Australia's Deterrence Mission

A security crisis would make the deterrence mission for Australia's SSNs especially difficult. Australia's SSNs will have the ability to operate in the South China Sea, a geographic area that is critical to the survival of China's retaliatory (or second strike) nuclear forces.

China's land- and air-based nuclear forces are projected to remain smaller than those of the United States, which are postured in relation to Russian nuclear forces. The asymmetry in Washington's and Beijing's nuclear forces, and the impressive gains made by the United States over the past twenty years in missile accuracy and remote sensing, mean that China has to worry about a counterforce strike against its nuclear forces, however unlikely that may be. The potential threat of a disarming strike on its land-based nuclear forces makes Beijing's relatively small and relatively noisy (and thus more easily detected) fleet of SSBNs central to its survivable second-strike capability.

China operates SSBNs from two bases: a northern base in the Yellow Sea, just east of Qingdao, and a southern base on Hainan Island in the South China Sea. The northern base in principle allows access to the open waters of the Pacific Ocean, but in practice it is too close to U.S. and allied anti-submarine warfare (ASW) forces that can operate from Japan, South Korea, and even Taiwan to guarantee survivability. That is why China built a base on Hainan Island, which allows the People's Liberation Army Navy a second route to open waters, or at least the ability to operate within the South China Sea itself, in what is sometimes referred to as a bastion strategy.

> **Longer patrols would allow Australian SSNs . . . to keep China's SSBNs at greater risk for longer. Even if this is not the Australian intention, at the very least China will fear this capability.**

Australia's conventionally powered submarines can spend around eleven days on station in the South China Sea today, but a nuclear-powered boat could spend up to seventy-seven days in the area. Longer patrols would allow Australian SSNs (and U.S. SSNs operating in the area more frequently due to resupplying at Australian bases as part of the AUKUS arrangement) to keep China's SSBNs at greater risk for longer. Even if this is not the Australian intention, at the very least China will fear this capability.

Counterintuitively, then, SSNs actually complicate Australia's deterrence mission. As far back as 1959, Bernard Brodie made this observation on deterrence theory:

> Our over-riding interest, for the enhancement of our deterrence posture, is of course in the security of our own retaliatory force. But that does not mean that we especially desire the other side's retaliatory force to be insecure. If the opponent feels insecure, we suffer the hazard of his being more trigger-happy.

A more nervous, nuclear-armed Beijing in a crisis does not necessarily mean that Australia will face fewer threats. In the worst case, it could instead mean Australia might be drawn into a U.S.-China conventional conflict that escalates to the nuclear level if China perceives that it faces a "use them or lose them" situation, in part owing to the threat Australian SSNs would pose.

The sole focus on the increased threat to adversaries posed by Australia's future SSNs, instead of also addressing the reassurance mission, could therefore actually compromise Canberra's ability to deter successfully. Of course, the task is exceedingly complex—it is not that threats should not be made, it is just that they need to be matched with reassurances. And getting this task right might be as difficult as acquiring and operating the submarines themselves. The trouble with threats and reassurances is that one tends to come at the expense of the other. The more threatening the capabilities, the harder it is to convince

others of defensive intentions. The more reassurances are given, the higher the risk of undermining the credibility of threats. This is a classic Goldilocks dilemma, in which the mix of threat and reassurance has to be just right.

What Can Australia Do?

The standard approach to reassuring an adversary is to rely upon arms control. It is a reasonably good form of reassurance not only because it demonstrates a willingness to show some kind of restraint but also because it actually places limits on one's own capabilities.

The trouble for Australia here is twofold. First, it is not, nor is it planning to become, nuclear armed. The threat that its SSNs will pose to China's nuclear forces will be a supplement to the threat posed by the United States (not so much a threat in its own right). So, there is not much that Australia can offer to China in a traditional arms control negotiation. Second, as has been well documented, strategic arms control among the nuclear-armed states is not exactly in rude health.

So, the traditional (imperfect and always fragile) forms of reassurance such as formal arms control are not easily achievable for Australia in the short term. Therefore, Australia will need to work hard to find creative alternatives to assure the recipients of its deterrent threats that its threats are limited and contingent upon their actions. This will likely require multiple initiatives but may include measures such as:

- geographically limiting submarine patrols;
- limiting the numbers of SSNs that are acquired (and can therefore deploy);
- potentially limiting the firepower aboard each vessel (although this can be harder to verify); and
- perhaps most importantly, working collaboratively with the United States on finding new forms of reassurance to bolster the joint deterrence mission for a post–arms control age.

If Australia can limit the effectiveness of its SSN fleet for strategic ASW missions, such that it will be unlikely to be perceived as threatening China's second-strike survivability, then its statements of reassurance will be more credible. While this is unlikely to mean formal arms control, for now, informal measures can and should be developed as a matter of priority to lay the ground for future, more formal avenues.

While the task certainly will not be easy, Australia must do more to address this reassurance challenge in developing a deterrence strategy for its future SSN capabilities. Failure to effectively reassure adversaries of the defensive nature of its SSNs may make the very threats they are meant to deter more severe.

04

The Brazilian Nuclear-Powered Submarine: Arguments for Deterrence and Development

Layla Dawood

Why has Brazil, a country with no obvious adversaries posing grave military threats, maintained its commitment to developing SSNs for almost five decades? Why would a non-nuclear weapon state pursue such a path, and how can the world trust its peaceful intentions? Arguments related to conventional deterrence, development, and pride help to clarify Brazil's position.

Deterrence of What?

When discussing the strategic need for SSNs, Brazilian authorities, particularly the Brazilian Navy, often cite deterrence as the primary reason. Conventional deterrence is the central concept of Brazilian defense policy, amplified through numerous defense policy papers. The 2024 National Defense Strategy states that deterrence is "a strategic attitude which, through any means, including military means, aims to discourage or divert real or potential adversaries from possible or presumed warlike purposes."[4]

Brazilian defense policy designates the South Atlantic Ocean as an area of geostrategic interest, making deterrence at sea a strategic priority. This region is an integral component of the so-called Brazilian strategic surroundings, encompassing South America, the South Atlantic, and Antarctica. In defense literature, this term is interpreted as a spatial representation of Brazil's political, diplomatic, economic, and military power projection aspirations, based on the geopolitical imagination of Brazil as a future great power. Therefore, the term refers to a project and a desire rather than an implication that Brazil currently possesses the necessary capabilities, including military capabilities, to act more forcefully in its areas of interest. However, according to Brazil's defense documents, protecting the natural resources in the country's jurisdictional waters, on the seabed, and in the subsoil is a current and persistent priority. The value attached to this area is such that it has been referred to as the Blue Amazon since the 2000s, drawing a clear comparison to the Green Amazon under Brazilian jurisdiction.

To protect its interest in the Blue Amazon, Brazil's primary objective has been to deny the use of the sea to any concentration of enemy forces approaching Brazil by sea. To this end, the 2008 National Defense Strategy established the doctrine of "uneven but joint development" to prioritize investment in a robust submarine force over a surface fleet. The document explains:

> In a broad spectrum of circumstances of combat, especially when the enemy forces are much more powerful, the surface force will be designed and operated as a tactical or strategic reserve. Preferably, and whenever the tactical situation permits, the surface force will be engaged in the conflict after the initial employment of the submarine force, that will act in coordination with space capabilities (for purposes of monitoring) and air power (for focused fire).

The documents that formalize the policy and the defense strategy of Brazil have attached great emphasis to both diesel and nuclear submarines over the years. There seems to be an unstated expectation that Brazil's capacity to undertake this first phase of submarine warfare has enough deterrent potential to prevent prospective adversaries from threatening Brazilian interests in the South Atlantic. And, according to the Navy, SSNs will enhance this deterrence effect, offering "extra advantages over conventional models" by allowing for greater autonomy of navigation and greater speed.

In this sense, the deterrence arguments presented by the Brazilian naval authorities resemble a strategy of deterrence by denial. In particular, SSNs are intended to deny an easy victory to a possible enemy by raising the costs of acting against Brazilian interests in the South Atlantic Ocean.

Deterrence of Whom?

Brazil's understanding of deterrence is also connected to the general deterrence concept, where targets are not always clear and threats are often directed at any potential aggressor. As the quote above demonstrates, Brazilian defense documents do not specify potential threat actors, at most referring more vaguely to situations "when the enemy forces are much more powerful."

In an effort to comprehend the potential sources of threat, and in the absence of clear references in defense papers, scholars have drawn attention to statements made by Brazilian officials that convey concerns about the North Atlantic Treaty Organization (NATO) and some of its members who may have ambitions in the South Atlantic. For example, Nelson Jobim, the Brazilian defense minister from 2007 to 2011, articulated his concerns regarding the 2010 NATO Strategic Concept and the risk that any of its members may try to use NATO "to promote multilateral actions without the support of the United Nations Security Council." According to Jobim, humanitarian and anti-terror missions should

not be used to justify NATO's intervention in the South Atlantic area. These comments followed an increase in Brazilian concerns about the surveillance and defense of sea lines of communication and resources in the Brazilian Continental Shelf following the United States' 2008 announcement that it would revive the Fourth Fleet, which is responsible for the U.S. naval presence in the South Atlantic. The United Kingdom's continued claim on the Falkland Islands (also known as the Islas Malvinas) could also act as a catalyst for tension. In addition, more recently, scholars have evaluated that China's rise and its increasing influence in Latin America and Africa could interfere with Brazil's influence in its strategic surroundings.

The presence of external powers in the South Atlantic is thus considered potentially contentious. Accordingly, Brazil's 2012 Defense White Paper (WP) invoked the 1986 United Nations General Assembly's Resolution N. 41/11, which establishes the South Atlantic as a peace and cooperation zone and calls on nuclear powers not to deploy nuclear weapons to that ocean. The 2012 WP states, "The military presence of [nuclear] states in the Atlantic Ocean should be reduced and, in future, eliminated. States located in other regions should not project on the South Atlantic any conflicts and rivalries that are alien to it." The 2024 WP again stresses that strengthening the zone will help consolidate Brazil as a relevant regional player, increasing its influence in its strategic surroundings and minimizing the possibility of military interference by extraregional powers in the South Atlantic Ocean. Nonetheless, the 2024 WP stresses that cooperation with countries bordering the South Atlantic Ocean should be used as the primary means of consolidating Brazil's influence in this area.

In short, Brazil bases its deterrence arguments on preventing extraregional influence in the South Atlantic Ocean. The SSN is intended to contribute to this mission by deterring aggressive strategies in the region. By emphasizing its defensive purposes, Brazil's deterrence policy is worded in a way that aims to reassure potential enemies and allies alike that deterrence will be pursued in accordance with Brazil's international nonproliferation commitments, its tradition of pacifism, and its nonoffensive defense strategy.

Whose Development?

Reassurance is not only related to Brazil's deterrence strategy; it is also an unintended consequence of the more persuasive reasons behind the decision to acquire SSNs. Scholars have pointed out the connection between defense and development in Brazil's nuclear policy. This defense-development nexus implies that Brazilian defense actors portray themselves as agents of development. This dates back to Brazil's military dictatorship, when the military was actively involved in government and, consequently, in planning the country's political and economic future. The idea that investing in SSNs would stimulate growth in other sectors of the national economy helped to justify the pursuit of such a costly endeavor by a developing country, especially to a domestic audience. In the late 2000s and 2010s, Brazil's Workers' Party administrations also used the development argument to justify the renewed focus on the nuclear submarine project.

Furthermore, the development of nuclear technology has been depicted as a sign of development and international status by Brazilian authorities. For example, in a 2014 speech, then president Dilma Rousseff stated:

> In an increasingly near future, the Brazilian naval force will be able to write yet another achievement in its history: to have contributed decisively to our nation joining the select group of five countries that are members of the United Nations Security Council and that have mastered the technology for building nuclear-powered submarines.

Consequently, the quest for technological autonomy has been a pivotal component of the program, where technological autonomy is regarded as a means of ensuring greater autonomy in foreign policy decisions.

Brazil bases its deterrence arguments on preventing extraregional influence in the South Atlantic Ocean.

Most importantly, however, the naval propulsion program—including mastering the uranium fuel cycle—is very much a project of the Brazilian Navy, reflecting the history of a bureaucracy seeking internal status. In this sense, Brazil's efforts to acquire this technology do not represent the path of a country seeking to divert technology from peaceful to military uses; rather, these efforts show a country, and especially a bureaucracy, pursuing recognition.

Consequently, international reassurance is not only the direct result of Brazilian authorities' wording on the continued commitment to the peaceful nature of Brazil's nuclear program but also an unintended consequence of this prolonged nuclear propulsion project. It is precisely because Brazil does not face direct threats that the country can afford to take this long to build SSNs. And it is exactly because having SSNs has become a matter of pride for the Navy that the rest of the world can rest assured that it is not a cover for a nuclear weapons program. The SSNs themselves are the project.

05

Naval Nuclear Propulsion in Non-Nuclear Weapon States: Some Safeguards Considerations

James Casterton

Among the myriad technical, logistical, and political issues that Australia and Brazil face in putting SSNs to sea is the matter of meeting international obligations to verify that the nuclear material involved in their programs is not being diverted for illicit weapons purposes. This verification challenge is significant because it is both narrowly bureaucratic and broadly geopolitical in nature. It will require adaptation of specific technical and logistical solutions to address problems that arise from safeguarding a complex activity for the first time. But it also stands as a test of the adaptability of the IAEA's safeguards system to technological change at a time of greater political contest of nonproliferation rules. What are the main issues Australia, Brazil, and the IAEA must address, and how can they do so in ways that ensure the continued viability of the safeguards system?

Australia and Brazil are working closely with the IAEA on the establishment of possible verification and monitoring activities with respect to nuclear material to be used as submarine fuel. These consultations are taking place pursuant to Article 14 of Australia's Comprehensive Safeguards Agreement (CSA) with the IAEA and Article 13 of the quadripartite agreement between Brazil, Argentina, the Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials (ABACC), and the IAEA. In so doing, both countries are presenting the IAEA with a very difficult challenge: how to provide assurances of the peaceful use of nuclear material for a "non-proscribed military activity" when the safeguards required by a CSA will not be applied to such material. (In the case of Brazil, safeguards will continue to be applied, but such application will require special procedures.) This is further complicated by the requirement to protect classified or otherwise sensitive information.

The IAEA must continue to be in a position to draw credible, annual safeguards conclusions for each state. The implementation of any safeguards approach must therefore be sufficient to support the annual safeguards conclusion. Given the nature of the challenge, Australia, Brazil, and to a lesser extent the IAEA will also have to undertake additional transparency measures to demonstrate that the nuclear submarine program of each state is being undertaken responsibly.

Some Safeguards Considerations

In order to continue to draw credible, annual safeguards conclusions, the IAEA Secretariat must be able to meet the generic objectives associated with a state's safeguards agreement. In the case of Brazil and Australia (or other countries with a CSA), those generic objectives are: to detect any diversion of declared nuclear material at declared facilities or locations outside facilities, to detect any undeclared production or processing of nuclear material at declared facilities or locations outside facilities, and to detect any undeclared nuclear material or activities in the state as a whole.

The complexity of and technical differences between the Australian and Brazilian naval nuclear propulsion programs mean that there is no one-size-fits-all safeguards approach applicable to both states (or to other CSA states that might pursue a naval nuclear propulsion program), even though the IAEA's safeguards objectives are the same in both cases. However, this does not present insurmountable challenges. The evolution of safeguards implementation over the years, particularly the advent of state-level approaches, provides a sound basis for adapting safeguards approaches for Australia and Brazil that consider the impact of nuclear material to be used as fuel for naval submarines. A central methodological feature of this approach is acquisition path analysis, which consists of analyzing all plausible routes, including through undeclared activities, by which a state could, from a technical point of view, acquire nuclear material that could be used for a nuclear weapon or other nuclear explosive devices. This analysis guides the development of relevant technical objectives for each state, which, in turn, guide the planning, conduct, and evaluation of safeguards activities for the state as a whole. Naval nuclear propulsion programs introduce new acquisition paths, which will lead to new technical objectives for the state.

> **Naval nuclear propulsion programs introduce new acquisition paths, which will lead to new technical objectives for the state.**

For the special arrangements or procedures pertaining to the submarine fuel, some traditional safeguards measures and concepts will not be applicable. For example, the detailed characteristics of the fuel design, including the nature and quantity of nuclear material contained therein, will be classified. This may mean that the IAEA Secretariat might have to deal with nominal values accompanied by some mechanism to confirm the

presence (or absence) of nuclear material in the fuel. Also, it is highly unlikely that the use of standard IAEA seals or remote monitoring equipment will be permissible on operating naval vessels. That being said, classification of information should not be used excessively in order to avoid verification.

Considerations such as these highlight the importance of developing safeguards approaches for Australia and for Brazil that do not concentrate solely on the special arrangements or procedures called for in Articles 14 and 13. They must also more broadly address the periods before and after the use of nuclear material to power the submarines as well as the impact on safeguards implementation in the state as a whole during the period when nuclear material is being used for fuel in the submarines.

Each state also presents practical safeguards implementation challenges that will need to be addressed. In the case of Australia, one challenge is to determine whether or not the HEU that Australia will receive from its AUKUS partners to be used as fuel needs to be brought onto the inventory pursuant to Australia's CSA prior to invoking Article 14. If so, when and how will this occur? Furthermore, given that the nuclear material will be received in welded power units and will remain inaccessible during the entire time that it is being used to fuel the submarines, and given that the total quantity and composition of the nuclear material will be classified information, do routine nuclear material accountancy measures apply? Other measures, such as IAEA inspector access to the submarine while it is in port or dry dock, may be sufficient to provide assurances that the fuel has not been diverted.

In the case of Brazil, the submarines, nuclear reactor, and low-enriched uranium fuel are being designed, developed, built, and assembled in Brazil. The technical design allows for refueling the reactor, which the Brazilian Navy intends to do to prolong the service lives of the submarines. The design and construction of the reactor (and its prototype), the enrichment of nuclear material to be used as fuel, and the fabrication of the fuel will all be undertaken subject to safeguards, recognizing the need to protect classified or otherwise sensitive information. But what will be the starting point of the special procedures relevant to Article 13? Will the special procedures pertain both to the fueling and defueling of the reactor and to when the nuclear material is being used as fuel for the reactor? Furthermore, since it is possible for fuel to be removed from the reactor, it is even more important that IAEA (and ABACC) inspectors have access to the submarines while they are in port or dry dock in order to confirm the non-diversion of the nuclear material.

The Importance of Transparency, Accountability, and Confidence-Building Measures

From the outset of the AUKUS announcement, some states, most particularly China and Russia, have expressed various concerns about the proliferation implications of the project. These concerns are based in part on what such states consider to be the risks associated with

the use of HEU as fuel and the transfer of HEU and nuclear submarine technology from two nuclear weapon states to a non-nuclear weapon state, hence their focus on the Australian and not the Brazilian program.

Although the concerns expressed by China and Russia seem largely influenced by geopolitical and strategic considerations, a broader objective and technical discussion of the possible risks to the nuclear nonproliferation regime posed by the pursuit of naval nuclear propulsion programs by non-nuclear weapon states may nevertheless be useful. Such a discussion could be undertaken or coordinated by, for example, think tanks or research centers. Part of the focus of these discussions could be the risks associated with the possible spread of enrichment technology to support naval nuclear propulsion programs.

From a safeguards process point of view, China has argued that there should be broad IAEA member state involvement in determining how an Article 14 arrangement pursuant to a CSA should be implemented and that the resulting approach should be approved by the IAEA Board of Governors (BOG) and the General Conference. However, as noted above, a one-size-fits-all approach to the implementation of Article 14 would not provide a suitable basis for credible safeguards conclusions. Furthermore, it is within the mandated responsibilities of the Secretariat to determine, in consultation with the state in question, how safeguards are to be implemented pursuant to the relevant safeguards agreement. This includes the implementation of Article 14 for Australia's naval nuclear propulsion program.

> **A one-size-fits-all approach to the implementation of Article 14 would not provide a suitable basis for credible safeguards conclusions.**

In due time, the resulting Australian arrangement as well as the Brazilian arrangement will be brought to the BOG. It is unclear whether the BOG will be asked to approve the arrangements. Regardless, it is difficult to envision the IAEA director general bringing arrangements for either initiative to the BOG unless the Secretariat in general and the director general in particular can demonstrate how such arrangements will support the continuation of credible safeguards conclusions for Australia and Brazil.

Notably, Director General Rafael Grossi has indicated that the agency's capability to develop suitable verification measures and an approach for AUKUS is enhanced by the fact that Australia is implementing an Additional Protocol (AP). Although Brazil does not have an AP in force, as part of the safeguards approach for its naval nuclear submarine program, Brazil could voluntarily implement some of the measures arising from the AP for the purpose of confidence building. These measures could include, for example, the provision of enhanced information about activities in Brazil as well as enhanced access to locations within the country, including to naval facilities relevant to the nuclear submarine program.

Looking Beyond Australia and Brazil

IAEA assurances about the peaceful use of naval nuclear propulsion programs in non-nuclear weapon states, although necessary, may not be sufficient. Australia and Brazil must continue to promote as much transparency as possible concerning the pursuit of their respective naval nuclear propulsion programs in order to provide increased confidence of the non-diversion of nuclear material used in those programs. At the same time, the IAEA director general must continue to routinely inform the BOG on the consultation status of the arrangements pursuant to Articles 14 and 13 and on any other developments relevant to the programs.

Of paramount importance is the need for Australia and Brazil to demonstrate to domestic audiences and the international community that these naval nuclear propulsion programs are being undertaken responsibly so as to address not only safeguards but also safety and security concerns.

06

Governance of Nuclear Submarine Programs in an Age of Uncertainty

Monica Herz

Australia and Brazil are developing SSNs in a political and normative context characterized by a broad crisis of multilateralism and the specific erosion of nuclear norms. The challenges of establishing governance structures for these SSN programs in this difficult environment are further exacerbated by the unique normative gap in which these programs sit. The programs mark the first time non-nuclear weapon states will use nuclear technology for military purposes; while this use is legally permitted, it operates in a gray area of the nonproliferation norms at the heart of nuclear governance. In tackling these challenges, however, Australia and Brazil can contribute to establishing trust and confidence in new governance structures that can set expectations for future, nonproscribed or nontraditional uses of nuclear technology.

The Erosion of Multilateral and Nuclear Norms

The development of SSNs by non-nuclear weapon states falls into a gap in the global structure of nuclear norms and therefore generates a demand for governance. The process of building norms around the use of these submarines, however, will occur against the backdrop of the confluence of a deep crisis in the multilateral system and the growing threat of the use of nuclear weapons.

The post–World War II, rules-based international political system and associated liberal international order are under severe stress, as many observers have discussed. Numerous factors help to explain this tendency, including the underrepresentation of Global South countries in apex multilateral decisionmaking processes, the rise of aggressive nationalism and the crisis of liberal democracy, and the destruction of humanist and interdependent worldviews. The Russian invasion of Ukraine, the Israeli massacre in Gaza, and the international lack of success in stopping these campaigns are the clearest expressions of this crisis. This is a world in which the legitimacy of international institutions is under threat, a zone of influence logic is on the rise, and some of the most powerful countries are

prioritizing short-term national gains over long-term global stability. The combination of these developments makes it very difficult to respond to new needs for global governance, including the use of SSNs by non-nuclear weapon states.

Building trust is a crucial pillar of global governance, especially in the sphere of international security. It is well established that trust-building among nations requires legitimate international or regional institutions and an understanding of interdependence and common humanity, as well as an expectation of long-term cooperation to sustain that trust. Today, however, existing trust flows are becoming more fragile, and some are being destroyed altogether; building new trust flows is even more difficult. The lack of transparency and common goals and language only feed this tendency.

At the same time, global nuclear norms are decaying. Strategic dialogue between Russia and the United States, the world's two nuclear superpowers, has largely withered, discouraging others from engaging in the construction of norms around the responsible possession of nuclear weapons. Multilateral efforts to prevent the further spread of nuclear weapons are under threat, contributing to a broader decay in multilateral nuclear diplomacy in venues ranging from the IAEA and Conference on Disarmament to the NPT Review Conference. And alongside these developments, new applications of nuclear technology for military uses by non-nuclear states begin to blur the boundary between legitimate nuclear applications and illicit weapons activities.

Especially concerning, discourse on the possible use of nuclear weapons has increased, a symptom of the erosion of the taboos that have prevented nuclear use since 1945 and limited proliferation. Russian President Vladimir Putin has threatened to use nuclear weapons in Ukraine to deter other powers from providing military assistance to Kyiv, which strengthens the association between coercion and the possible use of nuclear weapons. Russia's occupation of the Zaporizhzhia Nuclear Power Plant further challenges the basic safety principles of existing nuclear governance mechanisms.

The Challenges for the Governance of Nuclear-Powered Submarines

There is no specific norm against non-nuclear weapon states utilizing naval nuclear propulsion technology. Indeed, some foundational nuclear governance structures such as IAEA safeguards agreements envisioned this possibility, even though specific procedures to govern such use were never negotiated. To date, SSNs have only been utilized by nuclear-armed states, including in the context of their nuclear weapons operations and strategic deterrence postures, and therefore have operated largely outside of traditional nuclear governance. The Australian and Brazilian SSN programs thus raise new governance issues. International bodies, especially the IAEA, must reckon with these special cases at a time when international collaboration to uphold and evolve nuclear norms is ebbing.

Nuclear governance mechanisms are, in principle, robust, particularly regarding the safety and monitoring of technological development. The IAEA holds a level of legitimacy greater than other global governance institutions, stemming from its concentration of knowledge, statutory role under the NPT, and bilateral interactions with many countries. Yet its remit for governance of naval nuclear propulsion is narrowly confined to safeguards.

The specific characteristics of submarine fuel and the nature of naval operations, however, raise additional governance needs broadly, including in the proliferation domain. Global governance of SSNs by non-nuclear weapon states involves new security and safety provisions, global and regional dimensions, and specific features related to military operations. As researcher Leonam dos Santos Guimaraes discusses, SSNs by non-nuclear weapon states also pose unique technical, human resources, and cultural challenges related to accountability and responsibility. Among these are human health and environmental issues and concerns, especially in communities where the submarine fuel may be developed or stored.

Some of these issues must be addressed at local levels, but many will require complex diplomacy and negotiations by Australia and Brazil with the IAEA; with other relevant states, bilaterally and in other relevant venues; and between national authorities within Australia and Brazil. While some frameworks exist—such as Chapter VIII of the 1974 International Convention for the Safety of Life at Sea and the International Maritime Organization's Code of Safety for Nuclear Merchant Ships, Resolution A.491(XII)—these frameworks were designed when naval nuclear propulsion was still the purview of nuclear weapon states and not generally perceived as a subject of broader norms. In this context, there is a need for mechanisms to reassure various constituencies that these programs will be handled responsibly in ways that do not exacerbate proliferation risks.

Some of these issues must be addressed at local levels, but many will require complex diplomacy and negotiations by Australia and Brazil.

Key to ensuring that governance around the Australian and Brazilian programs embodies and promotes nonproliferation norms will be the exchange of information and comprehensive frameworks for protecting nuclear submarine fuel. Safeguarding nuclear materials, implementing strong physical protections, material control and accounting, continuous monitoring, facilitating remote handling and security against theft or diversion, and managing spent fuel and radioactive waste are all necessary—even as the specific procedures for applying these requirements to SSN programs are not in place. Establishing appropriate governance mechanisms that address these issues will require specification, negotiation, and a process of learning and adapting existing institutions, treaties, agreements, standards, and best practices. The diplomacy around the SSN programs undertaken by Australia and Brazil to date implicitly recognizes these gaps, but further actions are needed.

An Opportunity for Norm Enhancement

Despite myriad challenges, Australia's and Brazil's unique positions as the first non-nuclear states to pursue SSNs give them an opportunity to contribute to the enhancement of nuclear government mechanisms. Their efforts to demonstrate responsible stewardship, including by addressing regional security concerns, can help establish norms that could create expectations for future non-nuclear SSN aspirants and offer a positive perspective on norms for nuclear devices and their circulation.

The development of SSNs in both Brazil and Australia, and the two countries' approaches toward nuclear governance and the IAEA, are opportunities to strengthen trust and bolster institutions in the larger context of normative uncertainty: They represent the acceptance of international norms and rules and the need for adaptation and change as new projects and new technologies are developed. Complex institutional arrangements and intense investment by Brazil and Australia may not only allow for their nuclear propulsion projects to move ahead but also generate transparency, trust, and new international norms. More specifically, the precedents they are establishing in their engagements with the IAEA and with their neighbors, including through regional bodies, demonstrate this potential.

The two countries have track records of respect for multilateral institutions. They also hold significant capabilities in their own regions and so can invest in building trust at that level. Brazil has established a unique system of confidence building with its largest neighbor, Argentina, through ABACC. Brazil is currently negotiating the application of safeguards for its nuclear submarine program with the IAEA, in consultation with ABACC. According to Article 13 of the quadripartite safeguards agreement, the use of nuclear material for nuclear propulsion requires such "special procedures." In agreeing to this Article 13 requirement, Brazil and Argentina proactively sought to adapt safeguards for cases when nuclear propulsion could be used in nonprohibited military activities, including in submarines. In comparison, the standard language in a CSA allows for the nonapplication of safeguards for nonproscribed military activities. The forward-looking emphasis on special procedures, versus the removal of material from safeguards, indicates that Brazil, Argentina, and ABACC are ahead of the norm produced by the global regime. Thus, a positive expectation on safeguards regarding nuclear-powered submarines is built within the regional mechanism. Moreover, the involvement of ABACC in negotiations guarantees that relations of trust within the region will be maintained.

Meanwhile, the agreement among Australia, the United Kingdom, and the United States for cooperation related to naval nuclear propulsion, signed in August 2024, includes transparency measures. In particular, Australia must have in place a special safeguards arrangement with the IAEA and any necessary implementing mechanisms prior to the United Kingdom or the United States transferring any nuclear material for SSNs. Both Brazil and Australia are also parties to nuclear free zones—for Australia, the South Pacific

Nuclear Free Zone Treaty, and for Brazil, the Treaty for the Prohibition of Nuclear Weapons in Latin America and the Caribbean—which offers each country another venue for building trust with neighbors on this subject. The possibility thus is opened for the establishment, within an environment of trust, of a clear distinction between propulsion (even in military devices) and the use of nuclear technology as a weapon.

It is also useful to look beyond these cases as exemplary for adapting nuclear governance. Other nonproscribed or nontraditional uses of nuclear energy are on the horizon, ranging from nuclear-powered maritime vessels to space reactors. These applications, too, will fall into normative and governance gaps that will need to be addressed. Not only the process but also perhaps some of the key features of the trust-building efforts by Australia and Brazil can extend into these areas.

> **Other nonproscribed or nontraditional uses of nuclear energy . . . will fall into normative and governance gaps that will need to be addressed.**

The process of building norms and trust on the governance of nuclear-powered submarines is complex and will demand investment on all parts. It should also involve debates, including among elected representatives and civil society. But in the cases of Brazil and Australia, there is potential for a significant normative and governance contribution within the context of uncertainty. The construction of norms about SSNs, although very specific, can also contribute to transparency and common goals among actors willing to negotiate, invest in international norms, and accept limits to their national projects.

07

How Does Australia Understand "Responsible Nuclear Stewardship?" Applying a Regulatory Lens

Veronica L. Taylor

Invoking "Stewardship"

Australia regularly states its commitment to the responsible stewardship of its naval nuclear propulsion program. It is negotiating a special safeguards arrangement for the program with the IAEA in line with Article 14 of its CSA. It engages in frequent regional consultations with its Indo-Pacific neighbors on its SSN program, both bilaterally and in multilateral meetings such as the Pacific Islands Forum. The Australian government has also stepped up its efforts to build a social license for the program with a domestic audience—particularly among local and Indigenous (First Nations) communities in locations where the future nuclear-powered fleet will be berthed and serviced.

While the Australian government regularly emphasizes these acts as features of its responsible nuclear stewardship, what does this actually mean? How has Australia conceptualized the term, and what kind of regulatory standards does "responsible stewardship" imply? And how has Australia delivered on these standards to date?

"Nuclear Stewardship" Defined

"Stewardship" in the Judeo-Christian tradition originally meant authority ceded to an agent responsible for safeguarding property and enhancing its value. Today, stewardship is informed by Eleanor Ostrom's observation that societies need systems to check self-interest and protect against the risk of the destruction of shared resources.

"Nuclear stewardship" is a particular instance of stewarding the public interest. Radioactive materials are a resource, but the effects of accidents or hostile use are far-reaching and irreversible. Industry, defense, research, and regulatory actors who work with nuclear

materials and technologies thus often see themselves as unique because their responsibility is profound. Consequently, the idea of nuclear stewardship is described in different ways at international and national levels.

The IAEA uses the "three S" formula (referring to safety, security, and safeguards) to bound the international legal rules and practices that govern the use of nuclear technology.[5] It defines the stewardship of nuclear materials and technologies as the rules and practices controlling inventory, tracing, and verification—a core part of nuclear safeguards—in which industry is a vital co-regulator. It also uses "stewardship" as a way of describing the obligation to manage and dispose of nuclear waste and deal with contamination and remediation, including from historical experiments.

> **Australia's national approach to nuclear stewardship to date reflects the three S's.**

Australia's national approach to nuclear stewardship to date reflects the three S's. The Australian Nuclear Science and Technology Organisation—the government operator of Australia's only nuclear reactor—defines nuclear stewardship as "the responsible planning, operation, application, management, and leadership of nuclear facilities and technologies to ensure that the highest levels of **safety, security, safeguards and sustainability** are achieved to maximise utilisation, benefit, and assurance for the people of Australia."

The scope of Australia's nuclear stewardship, however, expanded significantly after Australia committed to pursuing SSNs as part of the AUKUS agreement. In 2023, the Defence Department created the Australian Submarine Agency (ASA), an entity tasked with commissioning and delivering Australia's SSN program. ASA also orients its mission around the 3S formula, with special emphasis on international nuclear safeguards.[6]

In its Corporate Plan 2024–2028, ASA commits to "the highest levels of safety, security and stewardship of naval nuclear propulsion technology" and defines its core activities to "exemplify best practice nuclear stewardship" to build and maintain naval nuclear propulsion technology, in compliance with Australian and international obligations.

Finally, the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) is the federal regulator of radiation safety and works with regulators for radiation safety in each state and territory.[7] Part of ARPANSA's role is to steward national radiation safety toward uniform safety standards.

Nuclear Stewardship As Regulatory Stewardship

In addition to the stewardship roles played by ASA, ARPANSA, and Australian Nuclear Science and Technology Organisation, Canberra is creating the Australian Naval Nuclear Power Safety Regulator (ANNPSR). ANNPSR will take over from ARPANSA for safety licensing of SSNs and their facilities. It will be an independent regulator outside the command structure of the Defence Department but will report to the minister of defence.

As a new regulator, ANNPSR is likely to be attentive to how civilian regulators in Australia operationalize the idea of "regulatory stewardship." Coined in New Zealand, regulatory stewardship has been widely adopted in Australia.[8] This means that in prioritizing the public interest, Australian regulators are required to do much more than business as usual. As regulatory stewards, they are responsible for adapting to new circumstances and scanning the horizon for potential disruptive forces. Stewards must act within the law, but legal rules by themselves are insufficient; stewards must go beyond the legal minimum and demonstrate ethical sensibilities and behaviors.

A key requirement of stewardship is coordination with other regulators to achieve shared objectives. This matters in an Australian landscape where, by the end of 2025, there will be at least eleven different regulators of nuclear safety, security, and safeguards; at least three government operators of nuclear facilities and/or waste facilities; and at least one private operator of nuclear waste disposal.

Regulatory stewards must also work with other actors and institutions to influence the "flow of events." Because the SSNs will significantly increase the number of sites and materials that will require safeguards verification within Australia, stewardship will require more than coordination with the 3S regulators; it will require cooperation with other agencies, such as the Australian Federal Police and Australian Border Force, and with a wide range of industry actors. This coordination is especially important in the Australian context because the technologies and standards for SSNs are being imported—and from the very different UK and U.S. national systems. Consequently, Australia is unlikely to have direct control over critical intellectual property and supply chain specifications, yet it will have the responsibility of licensing the construction, maintenance, and eventual decommissioning of SSNs while fulfilling international standards of safety, security, and safeguards.

> **Stewardship will require more than coordination with the 3S regulators; it will require cooperation with other agencies.**

Relatedly, regulatory stewardship requires transparency and attentiveness to earn the trust of stakeholders, including by being responsive to legitimate public criticism. Unlike older models of nuclear stewardship that relied on a single arbiter or a small group of experts, such responsiveness requires meaningful engagement with the public, such as First Nations communities and the wider society, as well as with neighboring countries in Asia and the Pacific, not least because of Australia's obligations under the 1986 South Pacific Nuclear Free Zone Treaty. The practical ways that this will work in Australia are still emerging.

Making Nuclear Stewardship Responsible

In Australia, the term "responsible" is currently standing in for the full scope of duties under "regulatory stewardship." For example, the Australian Defence Department states that it is prioritizing "the highest standards of nuclear safety . . . [to] continue the Australian Government's considered, phased approach to building an enduring legislative and regulatory framework for *responsible nuclear stewardship*" (emphasis added). The word "responsible" here is not defined in the relevant Australian legislation, but it is a formula used elsewhere by nuclear industry actors.

Adding words like "responsible" to a term such as "nuclear stewardship" boosts the expectation of conformity and compliance, as part of what regulatory scholars call "narrative regulation." The desirability of the norm—safety, security, and safeguarding of nuclear materials and technologies—is reinforced for multiple audiences by telling and retelling the story of how Australia plans to accomplish such stewardship. Some might see this effort as simply an instance of government spin, but global norms with regulatory effect are neither static nor self-enforcing. In other words, it is necessary to steward norms—including stewardship itself—by continually emphasizing them, sometimes in the face of active attempts to revise or undermine them.

Because AUKUS is still relatively new, the narration of Australian nuclear stewardship at present remains government centric. While this is not surprising for a country that has no nuclear power industry, it may change as ANNPSR emerges as a new and highly visible regulator—and as industry activity, workforce growth, and local community and First Nations involvement in the SSN program accelerates. Critical nongovernmental voices may also play a greater role in how the government expands its understanding of what constitutes responsible stewardship as the submarine program is implemented.

> **Critical nongovernmental voices may also play a greater role in how the government expands its understanding of what constitutes responsible stewardship.**

The Australian narrative of responsible nuclear stewardship (or what other regulators would simply call "regulatory stewardship") will also need to wrestle with some difficult historical failures and known, future problems for this nonproscribed military use of nuclear materials and technologies. Issues of truth-telling and compensation for First Nations peoples and veterans affected by nuclear weapons testing in the 1950s are ongoing and cast a fairly long shadow over all nuclear debate in Australia.

Of particular concern, the question of how to dispose of high-level nuclear waste remains unresolved. The AUKUS agreement requires Australia to dispose of all levels of nuclear waste from Australian submarines (but not from U.S. or UK vessels). Where and how that will happen is unknown. The Australian defense minister's position is that disposal

will occur on "Defence land" or "the Defence estate," but that formulation overlooks the reality that all land in Australia has traditional custodians, whether they are also recognized as owners (through holding "native title" in Australia) or not (for example, Crown land occupied by defense installations that is not subject to native title claims).

How Australia Is Going Beyond the Law

While some have argued for the importance of a credentials-based approach to responsible nuclear stewardship, a better question is to ask how Australia's regulatory approach is unfolding, and whether it can inform other new applications of nuclear technology, such as nuclear space propulsion, mobile or floating reactors, or nuclear-powered shipping, that will also require novel or adaptive approaches to safeguards at both the IAEA and national levels.

The first element of Australia's approach is its yearslong engagement with the IAEA to work through what this nonproscribed military purpose under Australia's CSA will mean in practice. Australia's AUKUS partners have made it clear that a successful negotiation with the IAEA is required before the technology transfer can proceed. While Australia has long been a supporter of the IAEA, this careful diplomacy is significant at a time when global support for nonproliferation and for the IAEA is vulnerable. At minimum, it signals that SSN programs by non-nuclear weapon states are onerous undertakings with important legal obligations—and that the IAEA is a consequential oversight institution.

A second feature of Australia's responsible nuclear stewardship is the quality of its legislative drafting and public opportunity for comment. When former prime minister Scott Morrison's government proposed the initial AUKUS agreement with the United Kingdom and the United States in 2021, the opposition party (now in government) had no opportunity to debate the proposal, nor was there any public consultation. The current Albanese government has made efforts to ensure that the 2024 Australian Naval Nuclear Power Safety Act and the 2025 regulations are in plain English with ample opportunities to notice and comment. The explanatory material for the primary legislation is unusually clear by Australian standards, using color and diagrams to explain something quite unfamiliar to the general public.

> **Australia's SSN program, however, relies on satisfying two very different allies in a febrile geopolitical environment.**

Australian governments are generally fairly sanguine about public criticism. Australia enjoys high levels of press freedom, open academic debate, and a supportive environment for nongovernmental organizations. Australia's SSN program, however, relies on satisfying two very different allies in a febrile geopolitical environment, making government and industry actors understandably (but unhelpfully) anxious about any criticism of the program.

The arrival of the new regulator, ANNPSR, may create greater transparency. ANNPSR's dual purpose will be to oversee safety within the naval nuclear program and to reassure both the local and international community that the public and the environment are protected. ANNPSR will work closely with the Australian Safeguards and Non-Proliferation Office, an independent regulator within the Australian Department of Foreign Affairs and Trade, which is responsible for extending and applying international safeguards practices to the new SSN environment. As a civilian regulator, independent of the defense command structures, ANNPSR will be subject to the Public Governance, Performance and Accountability Act 2013. That means that in addition to reporting annually to the minister of defense, the regulator will also report to the parliamentary Joint Committee of Public Accounts and Audit and be periodically audited by the Australian National Audit Office. This will generate much more public scrutiny than if the regulator was an extension of the Defence Department.

Importantly, as part of its commitment to creating a workforce able to deliver on the safety, security, and safeguards promise, the government has committed funding both to train the nuclear workforce in contemporary regulation as well as nuclear science and to establish the first national university qualification in nuclear security and safeguards.[9]

Going beyond what is required by law for responsible nuclear stewardship, the government has also acknowledged that it needs to earn a social license for the program and that local and First Nations communities have a direct and legitimate interest in the program's impact. ANNPSR's role and posture are likely to be important factors here.

While not publicly discussed at present, it would also seem likely that part of the outreach to neighboring states in Asia and the Pacific will be programs to share learnings, technical expertise, and normative values about regulatory stewardship, including transparency and public accountability. Australia's largest programs of official development assistance are with Pacific islands and Indonesia.

All of these efforts are happening in real time, so it is premature to assess the degree to which Australia is fulfilling all of the attributes of regulatory stewardship in relation to its SSN program. However, what is quite striking about the regulatory effort on SSNs is how much the government has invested in showing its seriousness of purpose regarding safety, security, and safeguards for this new use-case. That includes strong support for, and deference to, the IAEA and an acute awareness of how local communities and regional neighbors are likely to perceive its efforts.

08

Nuclear Submarines: A UK Perspective on Social License and Community Engagement

Mike Wareham

According to the IAEA, a social license in the context of a nuclear energy program refers to a project having "ongoing approval within the local community and among other stakeholders, and also . . . political and public acceptance." The challenges of earning and retaining that social license are particularly complex given the real and perceived risks of nuclear technology, especially for military programs in which security inevitably constrains openness and public engagement. Attaining a social license for a nuclear submarine program thus presents a unique combination of challenges for states pursuing them.

Though there are a range of stakeholders in such a social license, arguably the most important group is the local community closest to any nuclear hazard. This includes citizens who work at or in support of a nuclear base or facility and those who are affected on a daily basis by its inevitable impact on transport, housing, and schools, among other local resources. Understanding the issues and concerns of that community, identifying effective means of working with them, prioritizing those engagements, and keeping them relevant are vital to earning and retaining a social license.

For states embarking on nuclear submarine programs, what are the hallmarks of best practice for developing a social license, and what pitfalls should they understand in advance and seek to avoid?

This article is based on my personal experience from the UK submarine program, in which I first headed the safety team and subsequently was the base commander at the United Kingdom's main nuclear submarine operating base. In those positions, I worked closely with the local community and local government on issues central to social license. The article does not attempt to set out UK government policy, nor does it attempt to make the case for nuclear submarines. Rather, it offers some real-world examples relating to safety, cost, and regional impact, focusing particularly on effective methods for local community engagement.

The UK Case

The social license for nuclear submarines in the United Kingdom has evolved over sixty years, established against the backdrop of an expanding civil nuclear program and the Cold War. Much has changed since the first UK SSN was commissioned in 1963, but there remains broad public support for the nuclear submarine program, which is vital given the program's centrality to UK defense and its significant cost.

To develop engagement strategies, it can be helpful to consider the public in two broad categories:

- **The general public**: Remote from immediate issues, but concerned about safety and cost (both absolute and value for money)
- **The local community** (including the regional government): Concerned about safety and about the local impact on jobs, the economy, schools, and more, because the issue is on their doorstep

Drawing on the UK example, certain approaches have proved successful in building a social license for nuclear submarine programs with these two categories of stakeholders, with some main challenges.

Safety

The safety of any nuclear program needs to be assured by a competent regulatory authority. Generally, civil programs use an independent, government-appointed regulator, while military programs invariably use a defense regulatory authority, partly because of the sensitive nature of military technology and partly to recognize the unique operational context in which that technology may be used. The exclusive use of a defense regulator, however, can lead to public concern regarding independence and impartiality, undermining social license.

Demonstrating consistency between civil and military standards and the independence of the operational chain of command (and any associated program pressure) is an effective way of increasing public confidence. In the United Kingdom, the civil program is regulated by the Office for Nuclear Regulation and the defense operational program by the Defence Nuclear Safety Regulator. The defense regulator largely mirrors civil license conditions, is established to be independent of the operational chain of command, and complies with the secretary of state for defense's policy statement, which requires that the Ministry of Defence's arrangements "produce outcomes that are, so far as is reasonably practicable, at least as good as those required by UK legislation." In the case of the defense nuclear program, that means replicating, so far as practicable, the civil approach's various checks and balances in the military regulatory arrangements. Those factors—consistency of approach, maintenance of independent regulatory authority, and adoption of standards that are at least

as demanding as the civil nuclear program—are key to demonstrating a robust approach to safety, enabling the Ministry of Defence to take credit from the broad public acceptance of the UK's wider approach to nuclear safety regulation and long-standing civil nuclear social license.

Cost and Value For Money

Major projects have a reputation for being late and over-budget. Nuclear projects are among the worst offenders, with a widespread public expectation of budget and time overrun. One way to increase public confidence is to demonstrate that lessons have been learned from relevant previous projects, and the approach adapted to minimize the likelihood of similar failings. In the United Kingdom, Ministry of Defence nuclear infrastructure projects have been subject to extensive internal and independent reviews, including by the UK government's National Audit Office. Two particularly relevant reviews were the 2002 review of the D154 nuclear submarine refitting facilities in Plymouth and the broader 2020 report on managing infrastructure projects on nuclear-regulated sites. Both reports highlighted significant cost growth and delays to planned service dates, identifying several causes for those failings, including:

- Delivering novel and complex projects on sites designated nuclear-authorized or licensed
- Not fully understanding or costing project risks at the outset
- Not effectively managing or mitigating project risks
- Not agreeing on requirements early and leaving them subject to change
- Starting construction without a mature design
- Lacking a skilled workforce to deliver supporting documentation
- Making poor commercial arrangements

Many of those issues are not unique to nuclear projects. However, being able to demonstrate to the public—and to government stakeholders—that lessons have been understood is an important aspect of earning and retaining social license. Visibly and transparently addressing those lessons, and having them independently confirmed by organizations such as the UK government's Infrastructure and Projects Authority, increases public confidence as well as the probability of delivery to time and cost. Typical examples include robust management of the design, effective technical and project risk management, strong commercial arrangements, and transparency between defense and industry teams.

Local Government

From a local government perspective, social license is heavily influenced by the benefits and drawbacks of hosting a large industrial, commercial, and military site. Establishing good working relationships with local officials—both elected representatives and government employees—is key. During my time as base commander, for example, the submarine base was a significant local and regional direct employer and generated three to four jobs in the wider supply chain for every on-site role. That meant that more than 6,500 people were directly employed by the base, and more than 20,000 jobs indirectly depended on it. Service personnel and their families needed housing and schools, and they increased the demand for effective local transport networks. These demands could have strained already limited resources, but by understanding and aligning with the local government planning drumbeat, both the military and local community benefited. The military demand served to underpin the local social license, strengthening the argument for change and investment. Regular meetings between base staff and local officials ensured that the local government felt engaged and informed and that the military was better placed to develop a forward program that made the best use of regional opportunities.

Local Community

Establishing a social license with the local community is absolutely critical. Effective operation of the site on a daily basis relies on broad local support, given the very high level of interdependence between the base and the community. In many cases members of the local community may work at the base or have a family member or friend who does. Community members will need assurances about day-to-day safety and the risks of an off-site nuclear event, as well as more practical issues such as the impact on local services and transport networks.

Assurance and engagement are continuous efforts and should be delivered through formal and informal means. Formal sessions necessitate establishing regular meetings, such as a local liaison committee, that bring the public together with senior base representatives and regulators to discuss base safety performance and to summarize on-site activity and future plans. Informal sessions can range from visiting local schools, hosting community Navy Days, bringing members of the local community on-site, and sponsoring local events. Each of these activities needs to be developed as an integrated set of engagements, recognizing likely participants, their interests, and their concerns and tailoring the discussion and messaging accordingly.

Beyond those planned engagements, there will be numerous other routes by which local community opinions and views are shaped, not least through feedback from site employees to family and friends about the way in which the site is run, including the daily approach to safety. Some of the most effective safety campaigns link safety in the workplace to safety at home, as JMJ's Incident and Injury-Free program does, and every one of those engagements contributes in some way to building and sustaining a social license.

Conclusion

While a nuclear submarine program presents some unique challenges compared with a civil nuclear program or a major infrastructure project, the basic requirement to engage the public at multiple levels is unchanged. In the United Kingdom, identifying stakeholders, establishing relationships, and building trust remain key to retaining an effective social license. The UK case suggests a model for any state embarking on a nuclear submarine program. Of the many stakeholders involved, the local community arguably needs the greatest focus given its proximity to the risks and challenges of living alongside a defense nuclear facility. Engaging communities on multiple levels and through a variety of approaches offers an effective way to increase the likelihood of earning their support.

09

Strategic Development, Environmental Responsibility, and Democratic Accountability: Brazil's Nuclear Balance

Mariana Nascimento Plum

As Brazil enters a new phase in its nuclear development, public acceptance and environmental stewardship are becoming defining elements of a sustainable and legitimate program. The country's nuclear-powered submarine initiative, although primarily driven by strategic and technological imperatives, is increasingly entangled with expectations regarding transparency, environmental responsibility, and democratic accountability. The challenge is not only to build submarines but also to build trust.

Brazil's nuclear development is unfolding in a shifting global context. When the Submarine Development Program (PROSUB) was launched in 2008—announcing the construction of four diesel-electric submarines and one conventionally armed SSN—Brazil stood as the only non-nuclear weapon state pursuing an SSN program. In 2021, Australia followed suit, announcing plans for the acquisition of an SSN capability as part of AUKUS. Although the two projects are quite different, the AUKUS submarine initiative reinforced key concerns that Brazil's program had already raised: how to apply safeguards to SSNs operated by non-nuclear weapon states and how these initiatives might open the door for others to pursue similar capabilities, with potential risks for the nonproliferation regime.

At the same time, nuclear energy has returned to the center of global debates over the climate crisis and the energy transition. At the 2023 COP28 meeting, twenty-five countries, with the support of the IAEA, pledged to triple their nuclear energy capacities by 2050, underscoring nuclear energy's role in decarbonization.[10] However, around the world, this momentum has revived long-standing critiques over nuclear waste, safety, and financial sustainability, with many countries and civil society organizations instead urging prioritization of renewables. Nonproliferation concerns also persist, especially as new technologies complicate the IAEA safeguards system.

In this global context, Brazil has worked assiduously to demonstrate the peaceful nature of its nuclear program, which includes both civilian applications as well as the Navy's nuclear propulsion program. Specifically, Brazil asserts that the program complies with both Article IV of the NPT, which guarantees the right to peaceful nuclear development, and Article XXIII of the Brazilian Constitution, which restricts nuclear activities to peaceful purposes that do not undermine the nonproliferation regime.

> **Brazil has worked assiduously to demonstrate the peaceful nature of its nuclear program.**

While Brazil appears to be successfully addressing long-standing proliferation and disarmament tensions, particularly those surrounding the naval elements of its nuclear program, gaining and sustaining a social license presents more complex domestic challenges. Issues such as financial costs, environmental risks, and energy priorities have gained traction in national debates. Although SSNs are not the main focus of these disputes, the overlap between Brazil's civilian and military nuclear applications raises broader questions. The challenge for Brazil is whether its dual-track nuclear policy can secure the social license necessary to advance both energy and defense goals in the context of growing environmental and societal expectations.

Domestic Engagement Gaps

In international forums, Brazil has long affirmed its bona fides as a responsible steward of nuclear technology. Its nuclear nonproliferation and disarmament credentials include membership in the NPT and the Treaty for the Prohibition of Nuclear Weapons in Latin America and the Caribbean, which established Latin America as a nuclear-weapon-free zone, as well as participation in the unique bilateral verification arrangement with Argentina through ABACC, complementing its IAEA safeguards agreement. Diplomatically, Brazil also played a key role in negotiating the multilateral Treaty on the Prohibition of Nuclear Weapons, demonstrating a commitment to disarmament norms.[11] Exercising its rights and obligations under the current nonproliferation regime, Brazil is negotiating with the IAEA and ABACC over special procedures for naval fuel under Article 13 of the quadripartite safeguards agreement to operationalize safeguards for the nuclear propulsion project.[12]

At the domestic level, Brazil's SSN program has drawn limited public attention, unlike in Australia, where the AUKUS submarine initiative has sparked national debate. The comparative silence in Brazil reflects the limited role that defense and strategic issues play in the public sphere. For example, the National Defense Strategy and National Defense Policy—the highest-level documents guiding Brazil's defense planning—are subject to congressional review by law. Yet, during the 2016–2020 and 2020–2024 revision cycles of these documents, congressional evaluation took four years, undermining both the timeliness

and relevance of the review process and indicating a low level of priority. This trend may be improving, as the Brazilian National Congress reviewed the 2024–2028 versions of the defense documents within a year, offering a report with a handful of recommendations.

One of these recommendations addressed the submarine program, calling for greater transparency regarding its costs, timeline, strategic rationale, and the risks of not acquiring this capability. These issues were mainly framed in budgetary terms, reflecting a broader concern about justifying high-cost defense investments in a country still facing pressing needs in healthcare, education, security, infrastructure, and climate adaptation. The report emphasized that amid fiscal constraints, simply asserting the strategic importance of submarines is insufficient. A clear articulation of current capabilities, associated risks, projected costs, and a concrete timeline is needed to inform meaningful assessment by both Congress and Brazilian society.

> **A clear articulation of current capabilities, associated risks, projected costs, and a concrete timeline is needed to inform meaningful assessment.**

At the same time, the congressional report underscored the nexus between defense and national development. Brazil's nuclear energy and naval programs are deeply intertwined, shaped over decades through civilian and military collaboration and viewed as drivers of innovation, industrial capacity, national development, and sovereignty. This synergy is evident in major dual-use projects: from the naval-led development of uranium enrichment technology that now fuels the national energy grid, to the current civil-military partnership to build a multipurpose reactor for medical, industrial, and agricultural uses as well as advanced nuclear research.[13] These cases reflect the developmental dimension of Brazil's nuclear policy and show how coordinated investments across defense, science, and industry have sustained nuclear advancement while reinforcing integration between strategic priorities and public policy.

Challenges in the Civil Sector and Impacts on Nuclear Governance

Still, public trust in the nuclear sector is uneven. Concerns tend to emerge indirectly, focused more on environmental and social impacts from uranium mining and waste management than on naval applications. Incidents such as the 1987 Goiânia radiological accident involving cesium-137, as well as controversies surrounding mining projects in the municipalities of Caetité and Santa Quitéria, have fueled public skepticism.[14] In Santa Quitéria, for instance, Indigenous and rural communities have raised concerns over radioactive dust, water use, and lack of meaningful engagement with directly affected local populations. Despite a prolonged licensing process under environmental authorities, mistrust remains a barrier to a broader social license for the nuclear program.

Like so many other countries, Brazil is also struggling to develop permanent solutions for nuclear waste. Although the National Nuclear Energy Commission has announced plans for a permanent repository to serve both as a storage site and research center by 2029—called the Center for Nuclear and Environmental Technology—interim storage continues in different locations awaiting this definitive solution. Several municipalities have already rejected proposals for hosting long-term repositories, citing environmental risks and insufficient safety or financial guarantees. These rejections likely explain the commission's delay in naming the center's host city. While not directly tied to the submarine program, these issues shape public perceptions of nuclear governance.

These challenges converge with broader concerns about institutional capacity and infrastructure delivery. Consider the case of the Angra 3 Nuclear Power Plant. Construction began and quickly halted in the mid-1980s and remains incomplete today, its fate uncertain. It is part of the broader Angra complex, alongside operational units Angra 1 and Angra 2. Completion of Angra 3 would double Brazil's nuclear energy output and support decarbonization efforts. The issue gained international weight in June 2024 when IAEA Director General Rafael Grossi, speaking before the Brazilian National Congress's Mines and Energy Committee, advocated for the completion of Angra 3 and stressed that Brazil is essential to the global dialogue on nuclear energy.

But not all Brazilians are in favor of the site's completion. In early 2025, three former environment ministers joined over 450 civil society organizations, scientists, and activists in endorsing a public letter to President Luiz Inácio Lula da Silva opposing Angra 3. Coordinated by the Brazilian Antinuclear Articulation, the document cites costs, risks, and the urgent need to prioritize renewables. Although some federal officials support the project's completion, citing energy security and job creation, others call for a full reassessment. The National Energy Policy Council—the high-level inter-ministerial body responsible for strategic energy guidelines—has yet to resolve the issue, and so Angra 3 remains a symbol of stalled ambition.

The stalemate surrounding Angra 3 is critical precisely because it is at the heart of the logic of mutual dependence that underpins Brazil's entire nuclear enterprise. Completing the plant is seen as crucial to maintaining capabilities—in industry, infrastructure, and human capital—that sustain both energy generation and naval propulsion. Therefore, the fate of Angra 3 transcends the energy debate. It will be a test of the political viability and sustainability of the national nuclear strategy, including the nuclear submarine project.

Toward a Social License and Institutional Credibility

Brazil has recently taken steps to enhance public engagement around the nuclear program. For instance, the Institutional Security Office of the Presidency established a working group to improve communication and to counter misinformation, releasing a strategic communication plan for the nuclear sector in 2025.[15] The Navy, in turn, has distributed

educational materials, collaborated with universities and civil society, and organized site visits to Aramar (where the submarine nuclear reactor is being built) and to the Naval Shipyard of Itaguaí (where the SSN itself is being built). These initiatives are part of a broader effort to secure the program's social license and build national and international trust.

Furthermore, Brazil has also taken important steps to modernize its nuclear regulatory framework. In 2021, the Brazilian National Congress passed a law establishing the National Nuclear Safety Authority, fulfilling a requirement to separate promotion and oversight functions and thus aligning Brazil's governance with the standards of the 1994 Vienna Convention on Nuclear Safety.[16] The same 2021 legislation restructured the Navy's nuclear oversight: the Secretariat for Nuclear Safety and Quality, formerly under the Directorate of Nuclear and Technological Development of the Navy, now functions independently and licenses and monitors naval nuclear plants, including civilian ones. Together, these reforms represent a significant step toward strengthening institutional credibility and independent oversight, both of which are helpful for building public confidence in Brazil's nuclear program.

Brazil's case illustrates a broader principle: Strategic autonomy and technological ambition must be balanced with environmental stewardship and a social license. Democratic engagement, through hearings, consultations, and transparency, should be viewed not as an obstacle but as a source of legitimacy, sustainability, and continuity. Given their prolonged stagnation, both the SSN program and the Angra 3 project would benefit from adopting this approach.

> **Strategic autonomy and technological ambition must be balanced with environmental stewardship and a social license.**

This imperative remains acute in the wake of COP30. Having hosted the summit, Brazil faces enduring pressure to substantiate its leadership in environmental governance, just transition, and climate diplomacy. Nuclear technology is at the center of these debates—praised for low emissions, questioned for risks, and tied to Brazil's technological autonomy and industrial development. While the civilian sector emphasizes medical, agricultural, industrial, and energy applications, the military sector, particularly by way of the naval nuclear propulsion program, has historically driven technological breakthroughs. As the two sectors become increasingly interdependent, how Brazil manages this dual trajectory will shape its credibility as a green power and responsible steward of SSNs, both domestically and internationally. The way forward lies in integrating public trust into the core of Brazil's nuclear strategy, ensuring that technological progress, strategic goals, legitimacy, and environmental responsibility advance hand in hand.

10

Whose Voices Matter? Power, Legitimacy, Nuclear Legacies, and the Social License for AUKUS

Art Cotterell

When AUKUS was announced in September 2021, it was the first time the Australian public had heard of the decision for Australia to acquire SSNs through a partnership with the United Kingdom and United States. The secrecy was defended on national security grounds.

While deterring threats to Australia's national security is the oft-stated aim of the SSN initiative, a democratic imperative remains: greater opportunity for public debate. Democracy, after all, is among the very values Australia's future SSNs purport to protect.

Four years on, AUKUS—and particularly the SSN component of the initiative—retains bipartisan support. While the Australian public has heard wide-ranging perspectives on the SSN plans from former prime ministers across the political spectrum, as well as from strategic analysts and think tanks, far less has been heard from the public itself. Opportunities for such discussions have been rare. As one former Australian foreign minister bluntly put it: "AUKUS has no legitimate social licence because the public has been shut out of the process."

> **Opportunities for public discussions have been rare. As one former Australian foreign minister bluntly put it: "AUKUS has no legitimate social licence because the public has been shut out of the process."**

Yet talk of a social license for the SSNs under AUKUS raises more questions than answers. Who exactly is the "social"—the public—invoked in granting legitimacy to such a far-reaching defense project? Whose voices matter: politicians, defense and security experts, civil society groups, private citizens, local communities in proximity SSN facilities and activities, First Nations peoples? Can opinion polls or regulatory inquiries substitute for a national

debate or parliamentary inquiry? Given that First Nations peoples and Pacific island nations have long borne the brunt of enduring nuclear injustices rooted in weapons testing by AUKUS partners, how do unresolved nuclear legacies highlight the dangers of excluding the public from such debates?

Without meaningful public discussion, and more opportunities for communities to ask questions and be heard, secrecy and exclusion risks fostering a democratic deficit that erodes public trust over time—a vulnerability that may be as consequential as any submarine capability gap.

What Is a Social License and Who Gets to Grant It?

A social license to operate occurs when and where regulatory approval meets community acceptance. It implies trust-building, transparency, and meaningful and ongoing public engagement in decisionmaking. A social license depends on the continued consent of affected communities. At its core, an activity may have all the necessary political backing and legal authorization, but that does not necessarily equate to legitimacy in the eyes of the public.

Consent, moreover, is generally conditional, partial, and changeable. It is also never a one-off, box-ticking exercise. Communities may support some activities but reject others. They may also withdraw their support after a critical incident. For example, public acceptance of civilian nuclear power in the United States decreased in the aftermath of the Three Mile Island partial meltdown.

Even this description of social license is an oversimplification. Recent empirical research by Fiona Haines and her coauthors finds that legitimacy in the context of a social license is "hard to define or measure" because it relies on "social rather than legal legitimacy," making it "open to challenge." Even the word "license" lends a deceptive, quasi-legal authority to something inherently opaque. Their study identifies a range of ambiguities, including the source of authority in granting a social license.

> **In short, whose voices matter? Not all communities are treated as mattering in practice—or only retrospectively.**

In short, whose voices matter? Not all communities are treated as mattering in practice—or only retrospectively. Australia's nuclear legacy, and that of the United States and United Kingdom, speaks to nuclear injustices rooted in nuclear weapons testing. The AUKUS partners have a shared history of silencing those most affected, from First Nations peoples to Pacific island communities, only for the arc of history to bend belatedly—and still inadequately—toward recognition and reparations. As Haines and her colleagues argue, "A community can challenge a company's assertion of their social licence, but the company and its supporters can declare those opposed . . . as 'not representative' and so not authoritative."

In this manner, processes designed to obtain a social license can end up entrenching power rather than protecting the ability to speak to it. Defining community narrowly risks amplifying agreeable voices while sidelining dissent or dismissing it as mis- or disinformed. In this way, a social license can turn into social control, whereby consent is manufactured rather than earned.

A countercritique by Brian Lee Crowley is that "vital national projects cannot be held hostage to every grasping local interest" and that appealing to a social license can "become an attack on democracy." Yet in an ideal democracy, legitimacy is not only about majority rule but also about amplifying marginalized voices to ensure they are at least heard, if not also listened to. Those voices, with the passage of time, can become mainstream.

In a national security context, strategic imperatives can narrow the community even further, as seen with the initial announcement of the SSNs in Australia. This raises the question of whether the concept of a social license, which emerged in the mining industry before being taken up by corporations and governments, can meaningfully apply to a defense endeavor like AUKUS.

Opinion Polls Are No Substitute for Public Debate

When gauging public views on Australia's SSN program, the typical recourse is to turn to opinion polling. For example, in claiming public support, commentators and proponents regularly cite Lowy Institute polling that shows that, since 2021, about two-thirds of Australians "strongly" or "somewhat" support acquiring SSNs, with the remaining third opposed.

Yet polling cannot be a substitute for sustained public debate. Nor can it serve as a legitimate shorthand for evidence of a social license (notwithstanding limitations with the concept itself), particularly for such a multigenerational project with wide-ranging strategic, sovereignty, social, economic, and environmental consequences. As Wanning Sun, a professor at the University of Technology Sydney, cautions:

> Polling to gauge Australians' support for AUKUS is clearly a fraught exercise, partly because it is a devilishly complex topic that many members of the public—perhaps most of us—know disappointingly little about it. To a large extent, it depends on how you frame your questions, what information about AUKUS you include or leave out, and which aspects of public attitudes the questions tap into, and whether Australians are asked to respond on the basis of their short-term self-interest or the purported long-term benefits for the nation.

Despite these conceptual problems with polling as a stand-in for social license, the public survey results also highlight deeper tensions that make the need for public discussion more urgent. The same June 2025 Lowy Institute poll revealed that while 80 percent of Australians regarded the U.S. alliance as important to national security, trust in the United States to "act responsibly in the world" plunged to 36 percent—a 20-point decline coinciding with U.S. President Donald Trump's return to office, and the lowest in nearly two decades.

Further, a *Guardian* Essential poll conducted after the 2024 U.S. election but before Trump's second inauguration found that 48 percent favored reviewing AUKUS and the purchase of SSNs. These results may signal that public support is wavering. If a social license was lacking before, it is arguably even less evident now. Trump's early remarks—from asking "What does that mean?" when questioned about AUKUS to making tariff threats that did not spare allies like Australia—together with U.S. responses to global conflicts and creeping authoritarianism in the United States, may have understandably fueled doubts among those surveyed. Yet opportunities for meaningful public consultation on the AUKUS submarine initiative have been few and far between.

Regulatory Processes, Consultation, and the Limits of Public Scrutiny

In 2024, two regulatory milestones provided rare, formal opportunities for public input into the SSN initiative. These milestones also highlight the need for more public debate, as communities look for opportunities to raise their concerns. First, there was an Australian Senate committee inquiry on the Australian Naval Nuclear Power Safety Bill, designed to establish the regulatory framework and transitional arrangements for ANNPSR. The inquiry received forty submissions and, during the public hearings, heard from witnesses, including officials from the defense department, ASA, and ARPANSA, as well as representatives from civil society, industry, local government, and unions.

Throughout the inquiry, social license arose primarily in relation to radioactive waste disposal and storage, a febrile topic that generated media headlines over the bill's drafting that appeared to allow Australia to accept radioactive waste from its AUKUS partners. The bill was amended to limit Australia's disposal requirements to only the waste produced from Australian submarines, but the final inquiry report noted that "no decision has been made" on the storage of intermediate- and high-level waste. Instead, it indicated that such a decision would require "broader consultation" and "consideration of wider social licenses."

Radioactive waste will remain a contentious issue. As international relations expert Maria Rost Rublee recognized over a year before this inquiry:

> Social license is not something that technical personnel do to reassure emotional, uninformed members of the public. Instead, it involves an acknowledgement that what constitutes appropriate safety for nuclear waste storage is not just a technical issue—it is also a social and political judgment to be determined by communities in a democratic society.

The approach to consultation taken in the final legislation, however, is limiting and potentially forecloses additional opportunities for public discussion by ANNPSR. A dissenting report by a minor party and additional comments by independent senator Lidia Thorpe, a Gunnai, Gunditjmara, and Djab Wurrung woman, made recommendations to comply with the United Nations Declaration on the Rights of Indigenous Peoples, including the right to free, prior, and informed consent, and to institute a statutory requirement for accepting public comment on licensing applications.

The approach to consultation taken in the final legislation, however, is limiting and potentially forecloses additional opportunities for public discussion by ANNPSR.

The government response did not agree with these recommendations, stating that a statutory requirement in particular "could result in an unreasonable diversion of the Regulator's finite technical expertise and resources." It noted that the "absence of a statutory public submission process will not prevent or limit broader public engagement and consultation initiatives."

The second regulatory milestone of 2024 occurred when, after the bill became law, ASA submitted its first license application to the interim regulator to prepare a site for a prescribed radiation facility, to offer servicing and repairs services in support of a rotational presence of U.S. and UK submarines, and to manage and temporarily store low-level radioactive waste. That interim regulator, the existing ARPANSA, was the licensing authority until the new ANNPSR was established, making its approach to public consultation consequential.

As part of this licensing process, ARPANSA opted to invite public comment "due to the level of public interest and as this is the first licence application to ARPANSA from the newly formed [ASA]." ARPANSA received 165 public submissions, with recurring concerns regarding radiological safety and radioactive waste inventory, transport, and disposal. Some submissions expressed additional concerns around military targeting by "adverse forces" and reservations about the SSN program itself. The volume and content of submissions suggest communities want more, not fewer, opportunities for consultation, and are seeking avenues to be heard. In July 2024, ARPANSA issued its first license for the site, stating it was "committed to continuing to invite public comment on all future ASA facility licences."

With the commencement of ANNPSR and its new regulations in November 2025, Australia has shifted from a transitional to a permanent regulatory approach, offering further insight into how consultation will be handled—and who will be responsible. Whereas ARPANSA previously invited public submissions on license applications on a discretionary basis, the new regulations do not require ANNPSR to conduct consultations itself. Instead, the onus for consultation rests with applicants, while ANNPSR must be "satisfied" that "meaningful consultation has occurred" with "all relevant stakeholders," First Nations peoples, and the public. This arms-length model places responsibility in the hands of those seeking regulatory approval, and its legitimacy will likely depend on whether applicant-led consultation is conducted in a thorough and well-resourced way that supports public confidence in the process among a range of stakeholders.

Reckoning With Australia's Nuclear Legacies

The concerns about the future impact of the SSN program that emerged from the earlier Australian Senate committee inquiry in 2024 cannot be separated from Australia's nuclear history, which has traditionally been marked by a narrow public acceptance of nuclear technologies as well as enduring injustices. It bears reminding that Australia is a non-nuclear weapon state, with a long, demonstrated commitment to nonproliferation. Broad public awareness and support for peaceful uses, however, is centered on nuclear medicine and the operation of a single, multipurpose research reactor that manufactures and supplies medical radioisotopes to Australia and the world.

By comparison, civil nuclear power is legally prohibited, and recent debates on lifting these bans remain contested, with public opinion divided. Alongside this, Australia is one of the largest global producers of uranium for export—though precisely because of this public sentiment around nuclear technologies, it implements and carefully regulates restrictions on the use of that uranium. Australia's nuclear history is also one of protest. Campaigns against nuclear weapons testing and for disarmament have intersected with environmental, anti-war, Indigenous rights, and women's rights movements, and previously influenced government policy.

> **Any discussion of a social license for SSNs . . . must reckon with Australia's nuclear legacies and those of its AUKUS partners.**

Any discussion of a social license for SSNs enters this complex policy and political landscape—and more so must reckon with Australia's nuclear legacies and those of its AUKUS partners. Most notably, that includes British nuclear weapons testing at Emu Field and Maralinga in South Australia during the 1950s and 1960s. These tests forcibly displaced and dispossessed First Nations peoples and caused radiation exposure and deaths as well as environmental and cultural harm. Such nuclear colonialism has continued. As Adnyamathanha environmental studies scholar Jillian K. Marsh and her colleague Jim Green further observe:

> Aboriginal populations affected historically by the nuclear industry were excluded from the contemporary decision-making processes related to uranium and site development [including for radioactive waste] and continue to be subjected to intensive pressures imposed by government and industry.

This exclusion risks being repeated, particularly with the decision not to require free, prior, and informed consent as part of the ANNPSR licensing process. This risk cannot be ignored by decisionmakers.

Potential legal consequences may also exist, even for projects years in the making. For example, while not related to AUKUS, the Federal Court in 2023 overturned the site selection for a national radioactive waste facility after the Traditional Owners of the land, the Barngarla people, through the Barngarla Determination Aboriginal Corporation, successfully challenged the former minister's decision. Notably, the government did not appeal the decision, deciding instead to explore alternative sites, noting "We must consult widely and bring stakeholders, including First Nations people, along with us."

Such injustices extend into the Pacific Islands, where the United States and United Kingdom also undertook nuclear weapons testing. Many Australians have family and cultural ties to affected countries. Such transnational connections may mean domestic and regional perceptions of nuclear technologies are intertwined. Yet, social license discussions often fixate only on domestic sentiment. These histories and connections raise further questions about the legitimacy and power dynamics inherent in a social license, and whose voices are considered representative of the public.

Talk of a social license in Australia for the SSNs needs to broaden. The concept is ambiguous, ill-suited, and risks entrenching power by privileging some voices while sidelining others—currently marginalized voices that, in time, may become mainstream. Only by fostering a meaningful national discussion; enabling the public to ask questions and have input, including through meaningful consultation in regulatory licensing processes; and reckoning with its nuclear past can Australia avoid a democratic deficit that corrodes public trust—a vulnerability that, if left unaddressed, may ultimately undermine the national security AUKUS is said to safeguard.

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Notes

1 This role is most dramatically demonstrated in the sinking of the Argentine cruiser General Belgrano by the British SSN Conqueror during the Falklands War in 1982, after which the Argentine surface navy stopped contesting the British expeditionary force to retake the islands.

2 Canada's interest in SSNs in the 1980s was also consistent with these considerations, given its role in the defense of the North Atlantic along the Greenland-Iceland gap. It, however, abandoned the pursuit of SSNs with the end of the Cold War.

3 Range, though, remains a valid argument for the choice of HEU reactor designs over the low-enriched uranium designs of Brazil or France, which design nuclear submarines for operations closer to home.

4 Translations are the author's.

5 The IAEA has used this formulation since the late 2000s. International nuclear law is also organized around these themes.

6 While ASA talks about safeguards, Australia's nonproliferation obligations to the IAEA are the responsibility of the Australian Safeguards and Non-Proliferation Office, an independent regulator (or "statutory authority" in Australian terms) that sits within the Australian Department of Foreign Affairs and Trade.

7 ARPANSA operates within a federated political system, where delivery of health services, work health and safety, and occupational licensing are responsibilities devolved to the states.

8 Since 2024, Australian federal public servants have been legally obligated to exercise stewardship and understand the long-term impacts of their actions.

9 A Graduate Certificate of Nuclear Security and Safeguards, funded by the Australian Safeguards and Non-Proliferation Office's Verify program, is now offered nationally through the Australian National University and Charles Sturt University. The author is the academic lead on that project.

10 Brazil is not a signatory of the Declaration to Triple Nuclear Energy, launched at COP28. By the 2025 COP30 meeting, the initiative had grown to thirty-three countries: Armenia, Bulgaria, Canada, Croatia, the Czech Republic, El Salvador, Finland, France, Ghana, Hungary, Jamaica, Japan, Kazakhstan, Kenya, the Republic of Korea, Kosovo, Moldova, Mongolia, Morocco, the Netherlands, Nigeria, Poland, Romania, the Republic of Rwanda, Senegal, Slovakia, Slovenia, Sweden, Türkiye, Ukraine, the United Arab Emirates, the United Kingdom, and the United States of America.

11 However, Brazil's ratification of the treaty was blocked by the Chamber of Deputies' Defense and Foreign Relations Committee in December 2025, reflecting a legislative consensus that Brazil should not assume new restrictions without reciprocal disarmament by nuclear-armed states, which are actively expanding their stockpiles, modernizing delivery systems, and maintaining thousands of warheads on high operational alert.

12 Article 13 of the quadripartite safeguards agreement does not exempt naval nuclear propulsion from safeguards and requires that special procedures be negotiated and applied. This stipulation contrasts with Article 14 of most comprehensive safeguards agreements, which allows temporary exemption when nuclear material is used in a nonproscribed military activity.

13 See, for example, the collaboration between the Navy's Technological Center and the civilian Institute for Energy and Nuclear Research on enrichment technology, as well as the partnership between the Ministry of Science, Technology, and Innovation and the naval company Amazônia Azul Defense Technologies on the Brazilian Multipurpose Reactor.

14 This account is based on online interviews conducted by the author in February and March 2025 with former officials from the Ministry of Mines and Energy and the Brazilian Institute of Environment and Renewable Natural Resources. More context can be found in various Brazilian media reports, such as from the outlet g1.

15 The Institutional Security Office coordinates the Brazilian Nuclear Program Development Committee and is responsible for the Protection System of the Brazilian Nuclear Program. The plan structures the nuclear sector around four axes: technological (research, new technologies, and human resources), social (medicine and agriculture), economic (energy, industry, and mining), and defense (naval propulsion and SSNs).

16 Before the creation of the National Nuclear Safety Authority, the National Nuclear Energy Commission concentrated both regulatory and research roles.

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