



AUKUS, the brazilian nuclear-powered submarine, and the implications for the nuclear non-proliferation regime

AUKUS, o submarino de propulsão nuclear brasileiro e as implicações para o regime de não proliferação nuclear

AUKUS, el submarino brasileño de propulsión nuclear y las implicaciones para el régimen de no proliferación nuclear

DOI: 10.21530/ci.v18n1.2023.1299

Victoria Viana Souza Guimarães¹

João Vitor Tossini²

Copyright:

• This is an open-access article distributed under the terms of a Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided that the original author and source are credited.

• Este é um artigo publicado em acesso aberto e distribuído sob os termos da Licença de Atribuição Creative Commons, que permite uso irrestrito, distribuição e reprodução em qualquer meio, desde que o autor e a fonte originais sejam creditados.



Abstract

In 2021, Australia, the United States, and the United Kingdom announced the formation of a security partnership. Hence, Australia and Brazil could become states without nuclear weapons but with nuclear-powered submarines. The objective is to identify the consequences of the decision made by these countries to the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) and the International Atomic Energy Agency (IAEA) safeguard system. The methodology consisted of a literature review and comparative method. It was concluded that the main consequences are related

- 1 Doutoranda no Programa de Pós-Graduação em Relações Internacionais San Tiago Dantas (UNESP, UNICAMP, PUC-SP). Bolsista CAPES/BRASIL no projeto 88887.387832/2019-00 e no projeto 88887.696984/2022-00. (victoria.viana@unesp.br). ORCID: <https://orcid.org/0000-0002-4344-6542>.
- 2 Doutorando no Programa de Pós-Graduação em Relações Internacionais San Tiago Dantas (UNESP, UNICAMP, PUC-SP). Grant n° 2021/06878-4, São Paulo Research Foundation (FAPESP). (vitor.tossini@unesp.br). ORCID: <https://orcid.org/0000-0002-9844-4675>.

Artigo submetido em 31/08/2022 e aprovado em 30/04/2023.





to IAEA safeguards, nuclear proliferation and the reinforcement of inequalities within the NPT.

Keywords: Non-proliferation; AUKUS; Nuclear-powered submarine.

Resumo

Em 2021, Austrália, Estados Unidos e Reino Unido anunciaram a formação de uma parceria de segurança. Assim, Austrália e Brasil poderiam se tornar estados sem armas nucleares, mas com submarinos de propulsão nuclear. O objetivo é identificar as consequências da decisão desses países para o Tratado de Não Proliferação de Armas Nucleares (NPT) e o sistema de salvaguardas da Agência Internacional de Energia Atômica (AIEA). A metodologia consistiu na revisão de literatura e no método comparativo. Concluiu-se que as principais consequências estão relacionadas com as salvaguardas da AIEA, a proliferação nuclear e o reforço das desigualdades dentro do TNP.

Palavras-chaves: Não proliferação; AUKUS; Submarino de propulsão nuclear.

Resumen

En 2021, Australia, Estados Unidos y el Reino Unido anunciaron la formación de una asociación de seguridad. Por lo tanto, Australia y Brasil podrían convertirse en estados sin armas nucleares pero con submarinos de propulsión nuclear. El objetivo es identificar las consecuencias de la decisión tomada por estos países al Tratado sobre la No Proliferación de Armas Nucleares (TNP) y al sistema de salvaguardias del Organismo Internacional de Energía Atómica (OIEA). La metodología consistió en una revisión de literatura y un método comparativo. Se concluyó que las principales consecuencias están relacionadas con las salvaguardias del OIEA, la proliferación nuclear y el reforzamiento de las desigualdades dentro del TNP.

Palabras-clave: No proliferación; AUKUS; Submarino de propulsión nuclear.





Introduction

On September 15th, 2021, Australia, the United Kingdom, and the United States jointly announced the formation of a new trilateral security partnership in the Indo-Pacific, known by their initials: AUKUS. This security partnership is the initial result of a shared Anglo-American interest in reaffirming their strategic position in a region witnessing increasing strategic competition derived from a perceived Chinese security threat. In addition, to expand cooperation in defence and security between the three countries and increase their performance in the Indo-Pacific, through AUKUS, it was established that Australia would obtain nuclear-powered submarines. The Australian reasoning behind the deal is mainly based on perceived security threats in the Indo-Pacific, sharing similar strategic concerns with the British and Americans regarding China (White 2022). However, it should be noted that the then government took this decision with almost no consultation with the Opposition or the people of Australia. Thus, while it has been confirmed in March 2023 as going to proceed, there is some opposition to the proposal by many Australians based on cost, the timing of building these submarines, the risks to nuclear non-proliferation, nuclear waste disposal concerns, whether it is the optimal type of submarine to use, whether in fact, China is a threat and if so whether these submarines are the best response to this threat.

Australia is not the first country without nuclear weapons to embark on a nuclear submarine programme. Brazil has been working on developing a nuclear-powered submarine since the late 1970s. Although in the mid-1990s, the programme practically halted, in 2008, it received a new financial boost through the creation of the Submarine Development Program (Prosub). The Brazilian nuclear submarine programme has multiple drivers: protection of its coast and offshore natural resources, protection from potential enemies approaching from the sea, naval bureaucratic interests, and the country's desire to bolster its international standing (K assenova 2014). Thus, its drivers are quite different in comparison to the Australian case.

Despite their differences, both countries could become States without nuclear weapons but with nuclear technology for military purposes. It is important to emphasise that only six countries — the US, Russia, UK, France, China and India — currently possess nuclear-powered submarines. Therefore, Brazil and Australia would be the first non-nuclear-weapon states (NNWS) to maintain nuclear-powered submarines without nuclear strike capabilities. In the Treaty on





the Non-Proliferation of Nuclear Weapons (NPT) and the International Atomic Energy Agency (IAEA) safeguard system, there exists what many academics have called a “loophole” (Cormier 2022; Costa 2017; Kaplow 2017; Von Hippel 2019 ; Moltz 1998; 2005; 2006)³ or “grey area” (Desjardins; Rauf 1988) that allow NNWS to remove fissile material from the safeguards regime and use it in non-weapon and non-explosive related military applications like fuelling nuclear submarine reactors. Hence, acquiring or developing nuclear-powered submarines is not necessarily illegal, but as Marianne Hanson (2023) has pointed out it “undermines the spirit of the NPT” (verbal information).

Considering this context, the article’s objective consists in identifying the consequences of the decision made by these countries to the NPT and the IAEA safeguard system through a historical analysis. The research was designed around the question: What are the consequences for the NPT and the IAEA safeguard system derived from the AUKUS agreement and the Brazilian Nuclear-Powered Submarine? It is argued that the Brazilian and the Australian decision to pursue nuclear-powered submarines can encourage other countries to adopt a similar agenda, increase the challenges of controlling nuclear proliferation and deepen the inequalities within the NPT. Consequently, these cases imply an even bigger complication to the nuclear non-proliferation regime⁴, which faces several dilemmas due to a lack of advances in nuclear disarmament and the ongoing modernisation of nuclear arsenals.

This article employs the Comparative Method. According to Collier (1993, 105), comparison enhances our description capabilities, playing a central role in “concept-formation by bringing suggestive similarities and contrasts among cases” into focus. The types of occurrences largely influence the option to analyse a restricted number of cases under study and how they are defined. As noted by Collier (1993), the decision to explore a small number of cases can also be influenced by the relatively few instances of the phenomenon under exploration that possess the characteristic of interest to the analysts. This is precisely the case in this article since Brazil and Australia are the only countries that currently

3 The existence of this loophole has been contested by Silva (2022). Silva (2022) argues that, especially in the Brazilian case “it is not about a gap or loophole but the fact that it is the first time that arrangements for special procedures must be negotiated for the application of safeguards to nuclear material used for the propulsion of submarines of NNWS” (verbal information).

4 The nuclear non-proliferation regime comprises the NPT, a system of safeguards administered by the IAEA, nuclear-weapon-free zones, export control measures, and limits placed on nuclear testing, among other mechanisms.





share the inherent attributes of concerns to this article: the active pursuit of a nuclear-powered submarine while being a NNWS.

However, beyond a small number of cases, the Comparative Method requires highlighting the kind of “events” or the type of occurrences that will be considered. Therefore, the comparative axis applied to the Australian and Brazilian cases consists of a historical analysis that starts with each nation’s interest in a nuclear programme. In addition, other points considered for comparison are the reasoning behind such interest, the characteristics of the eventual nuclear-powered submarine programme, and the historical stance adopted by both countries regarding the non-proliferation regime and how they have been handling their nuclear submarine programme within the commitments to non-proliferation. Consequently, the Comparative Method demands a selective focus on the “events” chosen by the researchers as the axis of comparison, leading to a necessary centralisation around those events, reducing secondary issues (Beasley; Kaarbo, 1999).

The research consisted of a literature review of primary and secondary sources, which enabled the comparison of the two cases. According to Beasley and Kaarbo (1999), employing different types of sources in research using the Comparative Method is relevant because it reinforces the validity of definitions and conclusions. Comparing the two directly supports the analysis scrutiny of Australia’s and Brazil’s submarine programmes while providing a historical background for a better understanding of the motivations and reasoning behind each country’s programme.

The present article is divided into three sections, in addition to the introduction and the conclusion. The first section presents the Brazilian case and is more focused on the development of the nuclear-powered submarine programme and the country’s position in relation to safeguards. The second discusses the AUKUS deal and adopts an exploratory approach to understand Australia’s historical position in the nuclear non-proliferation regime and its perception of regional security that stimulated the collaboration with the United Kingdom and the United States to enhance its security. Finally, the third section compares the two cases and identifies some consequences of these cases for the nuclear non-proliferation regime.





The brazilian case

In the late 1970s, Brazil decided to pursue the development of a nuclear-powered submarine. Brasília made this decision when it tried to obtain the technology to enrich uranium. The transfer of West German ultracentrifugation technology to Brazil faced opposition from the US and the Soviet Union. Such opposition led to an agreement with West Germany in 1975 to develop enrichment technology by the jet nozzle method, which was revealed to be technically and economically impractical. Besides this, the country also had to deal with the safeguards that were part of the agreement with West Germany and the tripartite agreement with the IAEA. These agreements imposed severe limits on the length of research and experimentation carried out in the country with materials, technology and facilities related to the West German agreement (Silva; Moura 2018; Kassenova 2014).

As a result of these constraints imposed by major powers and international regimes, as well as the need to maintain and expand Brazilian energy capacity, Brazil opted to develop enrichment technology through covert means and by cooperating with other countries on the margins of the NPT (Silva; Moura 2018; Patti 2014; Bandarra 2016). This decision led to the creation of the Autonomous Nuclear Technology Program (also known as the parallel programme) in 1978. This programme was not related to international cooperation with West Germany. Therefore, it was not subjected to safeguards and did not need to obey the growing restrictions imposed by the US and the Nuclear Suppliers Group (NSG) (Patti 2014).

The Brazilian Navy launched two projects under this programme: Cyclone and Row. The first aimed to develop the fuel cycle with ultracentrifugation technology, while the second sought to develop naval nuclear propulsion with a vision to build nuclear submarines (Brasil 1985). “The Brazilian Navy, like all the navies in the world, saw in the nuclear submarine the solution to its strategic problem, a kind of technological rupture that would take it to the level of the best navies and place it in a position of great superiority over other navies who could not dispose of this weapon” (Vidigal 2002, 18). The decision to develop nuclear-powered submarines was also related to the perceived technological advantages such as speed, stealth and operational independence compared to the conventional counterparts (Sá 2015, 15-17).

Authors such as Kassenova (2014) and Sá (2015) argue that the navy’s nuclear-fuel-cycle efforts, the investment in civilian nuclear infrastructure and the development of the civilian nuclear programme was driven by the ambition to





build a nuclear-powered submarine. It should be noted that the navy's "pursuit of uranium enrichment and a nuclear submarine programme was the most determined and sustained effort" of the entire Autonomous Nuclear Technology Program (Kassenova, 2014, 23). In fact, the armed force that dedicated more time, resources, and personnel to the autonomous development of nuclear technology and had the most successful projects was the Navy (Bandarra 2016; Alvim; Goldemberg; Mafra 2018). It was successful in developing the nuclear cycle in the mid-1980s.

During Fernando Collor de Mello's administration, the government reduced the nuclear submarine programme funding. However, the appointment of Admiral Mário César Flores, one of the prominent supporters of the submarine programme, as Minister of the Navy guaranteed sufficient resources for the programme's survival (Martins Filho 2011). However, during the administrations of Itamar Franco and Fernando Henrique Cardoso, the Ministers of the Navy reduced the funds allocated to the programme, as they had a critical view of the support given by Admiral Flores to the programme (Martins Filho 2011; 2014). Thus, from the middle of that decade, the navy's programme practically halted (Martins Filho 2014).

The programme resumption occurred in the second mandate of President Lula's administration within a framework of strengthening the Ministry of Defence under Nelson Jobim (2007-2011). He imposed as a precondition for investments in the Armed Forces the elaboration of the National Defence Strategy (NDS) (Martins Filho 2011). The NDS placed among its guidelines the strengthening of strategic sectors: space, cyber and nuclear (Brasil 2012; Brasil 2020). The NDS also established as a strategic guideline the deterrence of hostile forces within the limits of its jurisdictional waters (Brasil 2012). Regarding deterrence against hostile forces in Brazilian jurisdictional waters, the document defined the strategic and operational objectives for the Navy. The established priority was to ensure the means to deny the use of the sea to enemy forces that approaches the country by sea to accomplish this the NDS established that the country "will have a large submarine naval force, made up of conventional submarines and nuclear-powered submarines. Brazil will maintain and develop its capacity to design and manufacture both conventional and nuclear-powered submarines" (Brasil 2012, 67,70).

In order to achieve these goals, Prosub was created in 2008, which provided, among other things, for the construction of a conventional nuclear-powered submarine (*submarino convencional de propulsão nuclear* — SCPN). In the same year, Brazil announced a partnership with France for, among other things, the construction of the hull of the submarine that will house nuclear propulsion





(Martins Filho 2014; Sá 2015. The project of the first SCPN started in 2009 and was expected to be concluded in 2032 (Ministério da Defesa 2019). In 2010, the country tried to acquire controllers (CPUs) from the US, that they would be more economically efficient; however, the purchase was denied and was accompanied by this note from the US Department of State: “The U.S. Government does not support Brazil’s indigenous naval nuclear reactor program” (Bezerril 2011). One of the biggest challenges this programme currently faces is the safeguards negotiations that Brazil initiated in May 2022 with the IAEA. In addition, the country also needs to secure the fuel for the submarine. Brazil had difficulties certifying the fuel it intends to use and has reached out to the United States and Russia. The first refused to offer support, while the negotiations with the second had to be stopped due to the War in Ukraine (Gielow 2022).

In relation to the negotiations with the IAEA, it is important to remember that Brazil did not sign the IAEA Model Additional Protocol (AP), also known as INFCIRC/540 (Corrected), created in 1997, due to its intrusive nature, sovereignty relativization, and the fact that more sensitive issues related to this protocol were linked to the protection of valuable technological and strategic information on the SCPN (Moura 2001). Furthermore, it must also be underscored that in the early 2010s, the NSG included as an eligibility criterion for the transfer of sensitive materials the ratification of the AP. Nevertheless, there was a reformulation in the group guidelines that explicitly accepted the Quadripartite Agreement⁵ (IAEA, 2016A: § 6 [c]). Hence, Brazil and Argentina were temporarily deemed in full compliance with the NSG guidelines (Herz; Lage 2013; Kassenova 2014). The Ministry of Foreign Affairs stated that this meant that “the NSG started to recognize the Quadripartite Agreement (...) as an alternative criterion to the Additional Protocol and the IAEA safeguards agreements” (MRE 2011). However, for Jonas, Carlson and Goorevich (2012), the NSG accepted ABACC’s claim that these mutual agreements (of the ABACC and the Common System for Accounting and Control of Nuclear Materials — SCCC) provided a higher level of security than the IAEA’s comprehensive safeguards per se, but did not accept the idea that these agreements are as strong as an AP.

Still in relation to the AP, in its 2012 NDS, Brazil made public its official position toward this protocol by stating that it would not adhere to additions to

⁵ Agreement between Brazil, Argentina, the Brazilian-Argentine Agency for Accounting and the International Atomic Energy Agency (IAEA) for the application of safeguards that its parties signed on December 13th, 1991.





the NPT which envisioned the expansion of this treaties' restrictions without the nuclear powers having advanced their own nuclear disarmament" (Brasil 2012, 96). However, in 2020 the NDS was revised, and the new text did not include that statement. The revision of the NDS is in line with the statement made by Kassenova, Perez, Spektor (2020) that it is possible to verify a flexibilization of the official position of Brazil which even though it does not conclude any additional protocol with the IAEA in the short term, does not exclude the possibility of discussing it in the future (Kassenova; Perez; Spektor 2020).

Kassenova, Perez, Spektor (2020) argue that Brazil is reluctant to accept additional non-proliferation obligations until substantial progress has been made toward nuclear disarmament by the existing nuclear weapon states as a matter of principle and understands that opening its facilities for more intrusive inspections under an AP would bring vulnerabilities about industrial espionage. Brazilian nuclear authorities claim that the country's uranium enrichment technology is indigenous and contains technological knowledge that the government wants to protect. Nevertheless, international experts on safeguards disagree, affirming that IAEA inspectors did not leak confidential information and even questioning whether the enrichment technology used in Brazil is entirely national (Kassenova; Perez; Spektor 2020).

To prevent negotiations that are not favourable to the country, Brazil anticipated its discussions with the IAEA after the announcement of AUKUS in late 2021. On June 6th, 2022, during the IAEA Director General's Introductory Statement to the Board of Governors, Grossi declared that Brazil had formally communicated "to initiate discussions with the Secretariat on an arrangement for Special Procedures for the use of nuclear material under safeguards in nuclear propulsion and in the operation of submarines and prototypes, as set out in the Quadripartite Safeguards Agreement" (IAEA 2022). As diplomats at the IAEA noted, this authorization is unlikely to occur without Brazil giving in to some historic positions (Gielow 2022).

The australian case

Australia's nuclear submarine programme is directly influenced by its American and British allies. It is worth mentioning that the British programme has been closely linked to the American one since the 1958 US-UK Mutual Defence





Agreement. The Agreement established high-level nuclear cooperation between the two countries and included the US selling “one complete submarine nuclear propulsion plant” to the British (Botti1987). Therefore, despite differences, the British cooperation with the Americans influenced subsequent nuclear propulsion designs of the UK’s Royal Navy.

Unlike the UK in the late 1950s, Australia in the early 2020s is not a nuclear weapon state; it has claimed it has no desire to diversify or create nuclear strike capabilities. However, during the 1950s and early 1960s, Australia was interested in obtaining nuclear weapons, particularly from the British. Nevertheless, British agreements of exchange of non-vital information with the Americans created challenges to establishing nuclear cooperation with “third countries”. The 1958 US-UK Mutual Defence Agreement further complicated the British position. Thus, the UK’s arrangement limited Australia as a partner for acquiring uranium and sites for British nuclear testing (Reynolds 1998). Even then, that did not impede further attempts from Canberra to acquire British atomic weapons.

In 1958, Australian officers approached the British Government enquiring about the possibility of purchasing tactical nuclear weapons. In 1961, Australia proposed a secret accord to transfer British nuclear weapons. Australian ambitions included acquiring and implementing the weapon under exclusive national control, effectively creating a nuclear power that would not have — at least initially — complete technical knowledge of its new military asset (Walsh 1997). Talks with the UK initially proved to be positive. Still, they did not advance due to the increasing British cooperation with the Americans and the latter’s reluctance to share nuclear information with third parties (Reynolds 1998).

Furthermore, China’s entry into the nuclear club in 1964, the 1968 announcement of the British withdrawal from regions East of Suez, and the growing worries about an American disengagement from Vietnam led to the persistent idea of nuclear capabilities as a partial reassurance to an Australian perception of its strategic isolation. Hence, there were further considerations and attempts to develop an indigenous nuclear capability between 1964 and 1972 (Walsh 1997). In 1968, Australia was asked to sign the NPT, which would result in a renouncement of nuclear weapons. During the next two years, the Australian Government was divided on this issue. Within that context, Canberra launched a study programme to build an indigenous nuclear fuel cycle, which would allow the manufacture of atomic weapons. By 1970, Japan, Italy, and West Germany had signed the NPT, strengthening the position of the NPT supporters





in the country. Changes in government between 1971 and 1972 weakened the hand of the proponents of an Australian nuclear bomb resulting in the adoption of a policy of “nuclear abstinence”, with Australia signing the NPT in 1970, and ratifying it in 1973 (Walsh 1997).

In the following decades, the quest for a nuclear weapon disappeared from the Australian political debate, and its civilian nuclear infrastructure remained circumscribed by growing international obligations. When Canberra ratified the NPT in 1973, the opposition to nuclear weapons prevailed as the national political consensus. That same year, Australia and New Zealand submitted a case against the French nuclear tests in French Polynesia to the International Court of Justice. Similarly, Chinese tests caused public and governmental declarations of disapproval, reinforcing the growing role of Australia in the nuclear non-proliferation regime (Weltman 1981).

Since the 1970s, consecutive governments in Canberra have supported the nuclear non-proliferation and disarmament regime. According to Watson (2020), this position can be seen through the Australian championing of the Comprehensive Nuclear-Test-Ban Treaty (CTBT), the South Pacific Nuclear Free Zone Treaty (Treaty of Rarotonga), and contributions to the International Partnership for Nuclear Disarmament Verification (IPNDV). It is worth noting that, in 2007, the International Campaign to Abolish Nuclear Weapons (ICAN) was founded in the country by a coalition of non-governmental organisations led by the Medical Association for the Prevention of War (Australia) (ICAN, 2022). Australia also conducts contacts to encourage other countries to sign and ratify the IAEA AP, opening the way for enhanced inspections, and is one of the founding members of the Proliferation Security Initiative (Watson 2020). Concerning the AP, Australia took a leading position within the nuclear non-proliferation regime and became the first country to adopt the Protocol in September 1997 (IAEA 1997). Moreover, the government has sponsored non-proliferation initiatives, including the Canberra Commission on the Elimination of Nuclear Weapons in 1995-1996 and the Non-Proliferation and Disarmament Initiative in 2010. Lastly, the government’s export of nuclear materials is rigorously controlled by international and domestic obligations. However, this position has shifted between commercial gains and a restrained approach aligned with its non-proliferation stance (Watson 2020).

Despite this, Australia has still not signed the Treaty on the Prohibition of Nuclear Weapons (TPNW) after it was opened for signature in September 2017. The central reservations of Canberra on the issue are said to be the need





for universality, strong verification provisions and compatibility with the NPT (Watson 2020). Many observers point out that these are unnecessary or contrived concerns and that the real reason Australia has not (yet) signed is its alliance with the US⁶. Despite that, in 2022, the Labor Party was victorious in the Australian federal election replacing the Liberal-National Coalition in government. When in the Opposition, the new Prime Minister, Anthony Albanese, was an avid supporter of the TPNW indicating that once in government, his Party would sign. Nonetheless, this has not yet happened. The new government continues to consider the country's stance on the TPNW and still needs to officially change its position on the issue (Doherty 2022).

Concomitantly, in the 2010s and early 2020s, there was a determined shift against China in Canberra, based on Chinese military expansion, but also often exaggerated and seen as a direct security threat to Australia. Many analysts have condemned what they see as China-scaremongering tactics. Nonetheless, the anti-China faction successfully increased the pursuit of enhanced conventional capabilities and defence partnerships. AUKUS symbolises the growing willingness of its members to create initiatives that allow the strengthening of their strategic positions in the Indo-Pacific. As already mentioned, the highlight of the security partnership is the planned joint endeavour between the three nations to assist in developing Australia's nuclear-powered submarines (Australia 2021a). This partnership indicates the informal establishment of a "conditional proliferation" in the international regulatory system, enhancing the inequalities present within the treaty.

Considering that the three nations have strategic concerns in the Indo-Pacific, the Australian nuclear submarines programme is seen as a reassurance. It must be noted, however, that there is considerable resistance to this narrative within Australia. Many China experts within Australia do not believe that China poses a military threat to Australia or that Australia should join in a war against China. There is considerable push-back against the dramatic shift towards an anti-China stance, and many Australians are unhappy about closer enmeshment with the American military (Carr 2023; Keating 2023; Kenny; White 2023; Mackerras

⁶ The ANZUS alliance carries no guarantee that the US will come to the aid of Australia. It merely commits each state to discuss options making no mention of any nuclear umbrella. Thus, the assumption that Australia is under extended nuclear deterrence is self-anointed. This has led advocates of the TPNW to argue that Australia can maintain the ANZUS alliance and join the TPNW. It would, however, have to renounce any association with nuclear deterrence (Kelly 2020).





2020; Menadue 2023; Tanter 2023). The government states that the partnership with the British and Americans is an effort to meet the “challenges” of a world that is becoming more complex, especially in the Indo-Pacific. According to the Australian Government, AUKUS was born as a security initiative to “enable and empower” its members and allies (Australia 2021b) and “to enhance our joint capabilities and interoperability” (Australia 2021a). Although not directly addressed, the strategic concern with a rising China and possible Australian isolation in a scenario of weakening Anglo-American influence in the Indo-Pacific concerns Canberra.

Security worries in Canberra, London and Washington about such waning of the American — and to a lesser extent British — influence in the region are reinforced by statements from officers of the US Armed Forces on Beijing’s expanding military capabilities. These declarations include estimates that China is growing its military assets five to six times faster than the United States (Norman 2022); while, between 2020 and 2021, the UK, witnessed its defence budget fall for two consecutive years (Sabbagh 2022).

The Australian quest to replace the conventional diesel-powered Collins-class submarines goes back to 2009 when the Australian Government published the defence White Paper “Defending Australia in the Asia Pacific Century”, committing to the pursuit of a “conventional” replacement for the Collins and doubling the size of the submarine fleet in the future (Australia 2009, p. 70-71). In 2010, Royal Australian Navy (RAN) officers raised the possibility of acquiring nuclear-powered submarines through the British (Reynolds 2013). Nevertheless, that idea did not advance, and the 2013 Defence White Paper maintained the commitment to new and more capable “conventional” submarines (Australia 2013). The 2013 decision was criticised by some officers of RAN and the Navy League of Australia, arguing for the nuclear-powered option since the decommissioning of the Oberon class that preceded the Collins (Reynolds 2013). In 2016, Canberra announced that the French-backed bid had won the procurement for the 12 hulls. However, plans for the French-backed project were ended when AUKUS was announced.

In March 2023, the members of AUKUS announced that — pending US Congress approval — Australia would purchase in the early 2030s three Virginia-class nuclear-powered submarines from the US, with an option for two more if requested. These submarines are temporary solutions until a new design is in active service in the RAN in the 2040s. That same month, Australia decided





to select the British design to be its future nuclear-powered submarine. The British design is also planned to use American technology, making it a direct by-product of the AUKUS agreement (Doherty; Hurst 2023). The RAN will have access to American and British bases and might even have permission to base its submarines in Japan. The nuclear reactors will not be built in Australia; they will arrive from the UK and the US in a “wielded power unit”, not requiring refuelling during their lifetime. Thus, Australia will not access the technology in question. Moreover, the country also stated that it would not enrich uranium for the submarines but has plans to manage all radioactive waste generated by the vessels (Doherty; Hurst 2023).

The advent of AUKUS has changed Australia’s position within the international nuclear non-proliferation regime and increased its strategic alignment and cooperation with the US and the UK (Reynolds 1998). For Hanson (2023), “it appears to be a conscious decision to switch from a defensive security approach to an undeniably aggressive approach” (verbal information). The Australian case might contribute to the creation by the US and the UK of a “double standard”, for these two powers directly support the Australian nuclear naval propulsion programme while adopting punishing measures to potential adversaries that may try the same (Acton 2021). Furthermore, both London and Washington see Canberra as a “responsible” partner who can receive their nuclear propulsion technology without proliferation risks. However, while trying to enhance the strategic stance of its three members, the precedents that the AUKUS submarine deal might open have the potential to weaken the overall nuclear non-proliferation regime. Hence, the losses might outweigh the strategic gains from AUKUS.

NNWS with nuclear-powered submarines and the non-proliferation regime

As seen by the previous two sections, the Brazilian and the Australian case have many differences and similarities. In terms of differences, the following points can be emphasised. First, Brazil developed an indigenous technology to enrich uranium and is developing the nuclear part of the submarine on its own. At the same time, Australia has not developed technology to enrich uranium. It will receive aid from Washington and London for its nuclear fuel — which can be characterised as a framework of conditional proliferation and reinforcement





of inequality within the Treaty. Unlike the Brazilian case, the Australian case and the significance of AUKUS as a whole have spurred much concern among its neighbours — Southeast nations and South Pacific states. It should be noted that Brazil plans to use LEU while Australia plans to use HEU, thus posing an even more complex problem. Second, while Canberra signed the AP in the year the protocol was created, Brasília still resists signing it. In the meantime, Brasília signed the TPNW and has given significant support for the creation of the Treaty, while Canberra has not yet supported it. Nonetheless, it is essential to note that both countries are reviewing such positions as discussed in the previous sections — Brazil about the AP and Australia in relation to the TPNW.

Although there are differences, there are also some similarities. Both countries have good credentials in the non-proliferation regime⁷, both are NNWS pursuing nuclear-powered submarines and both need to deal with the need to close the loophole in the NPT and IAEA safeguard system. In this sense one of the most important consequences that these cases present to the nuclear non-proliferation regime is safeguarding the nuclear material and the proliferation aspect that it opens. The possibility of Brazil and/or Australia, NNWS, commissioning nuclear-powered submarines in the near future raises the issue of enforcing nuclear safeguards for naval fuel. The practice accepted by these countries might set a precedent for other NNWS. Concerns with the AUKUS nuclear submarine partnership centre on the precedent it opens within the international nuclear non-proliferation regime. As Acton (2021) argues, would-be proliferators might use the reactor programme as a disguise for the development of nuclear weapons and the Australian precedent and/or Brazilian precedent may reduce the political cost of adopting such a policy.

According to Kaplow (2017), the reason for this proliferation risk lies in the language used in the NPT, which arguably allows States to exempt nuclear material from international safeguards for use in nuclear submarines. The nuclear fuel that powers naval reactors, especially HEU, could be useful for making nuclear weapons, so there has long been a concern that countries could divert exempt materials into a nuclear weapons programme without the inspectors' knowledge. As the NPT does not address military uses of nuclear technology other than nuclear weapons, it was up to the IAEA to create rules on how to

7 Brazil is a member of the NSG and the New Agenda Coalition. It has placed in force many important treaties such as the Treaty of Tlatelolco, the Partial Test Ban Treaty and the NPT as well as signed the Missile Technology Control Regime and the TPNW.





protect enriched uranium intended for use in naval military reactors. However, recognising that international inspections of military installations would lead to a political impasse, the IAEA chose to rely on State declarations (Kaplow 2017). This can be verified in paragraph 14 of INFCIRC/153. According to it, States, when exempting nuclear material from safeguards for use in non-prescribed military activity, must declare the activity and quantity of material used, provide guarantees that the material will not be used for the production of nuclear weapons and agree to reinstate safeguards in the material when its use is reintroduced for peaceful nuclear activities. Nonetheless, according to Kaplow (2017), the IAEA sometimes does not seek to verify these statements, so States may view this exemption as a convenient way to divert nuclear material for use in a secret weapons programme.

Failure to address military non-explosive uses of nuclear technology in the NPT was not an accident. Early drafts of the Treaty were written in a way that would require the NNWS to place all of their nuclear activities under safeguards. Notwithstanding, in 1968, when the Treaty was opened for signature, Article III excluded military non-explosive uses such as naval propulsion. The change was related to the complex dynamics of Treaty negotiations, in which two factors are noteworthy. First, the US recognised that the NPT would be effective only to the extent that it received broad international adherence. Second, the Treaty was criticised for being asymmetrical, allowing the NWS to be treated differently from the NNWS — to soften this situation, the US voluntarily offered to implement IAEA safeguards in its civilian facilities. Still, as with the other NWS, the US was unwilling to allow its military facilities to be examined via safeguards. If the NPT required NNWS to place non-explosive military activities under safeguards or prohibited such activities, it could have been seen as another way in which the NNWS would be asked to bear a heavier burden of the Treaty (Kaplow 2017).

Currently, any attempt by a would-be proliferating state to withdraw nuclear material from safeguards for a nuclear submarine programme can be seen as a potential step toward developing nuclear weapons. Thus, the naval propulsion gap presents an opportunity for potential proliferators to manufacture nuclear weapons. However, the warning power of the naval nuclear propulsion gap today is partly due to the fact that no state has yet taken advantage of it. Thus, if a precedent that legitimises the non-explosive military use of nuclear material is established, the second state to use the exemption will find it easier to acquire sensitive technology, face less international pressure to change course, and raise





fewer proliferation alarms that could make it a very dangerous breach. Thus, it is reasonable to seek to prevent countries from exercising the exemption or, if a precedent is needed, to try to reduce its damage (Kaplow 2017). It is important to emphasise that various proposals have been made to deal with the NPT loophole and several of them recommend the development of naval nuclear propulsion safeguards, the prioritisation of activities using low enriched uranium (LEU) instead of HEU as well as discussions on the possibility of a future Fissile Material Cut-Off Treaty (FMCT) that includes materials for naval propulsion⁸.

Regarding the prioritisation of LEU over HEU, it is essential to note that the nuclear propulsion of the Royal Navy and US Navy's submarines require HEU that can be used to produce nuclear weapons. This level of uranium enrichment to be used in Australia's submarines has become a source of concern to many observers, as it might weaken the IAEA safeguards system. Meanwhile, in the Brazilian case, due to technical obstacles and economic disadvantages that can be very difficult to overcome, some authorities, while reaffirming the commitment to LEU fuel, have suggested the possibility that it will be closer to the 20% threshold of U-235 (Costa 2017; Spektor 2017). Hence, Costa (2017, p. 8-10) suggests that, albeit not certain from a technical point of view, the degree of uranium enrichment which will be used in the nuclear material for the reactor fuel should be clearly disclosed, as this would help alleviate concerns and avoid unpleasant surprises.

The Brazilian nuclear-powered submarine and the AUKUS create a precedent for many countries, such as South Korea, Japan, Canada, Pakistan, Iran and Argentina, to pursue nuclear submarines. These countries have already demonstrated interest in pursuing this goal in the past. Under AUKUS, the difficulties experienced in the past will be facilitated since the US and UK are willing to share technology with a 'partner' seen as responsible, and Western.

Conclusion

According to Kassenova (2014, 4), Brazil's perception of the non-proliferation regime is that it is unfair, it benefits the NWS, and it puts undue pressure on NNWS. Furthermore, the lack of progress toward nuclear disarmament and the questionable policy choices of NWS allows Brazil to claim that NNWS should not be expected

⁸ For more information on proposals to deal with the NPT loophole, see: Egel; Goldblum; Suzuki 2015; Kaplow 2017; Shea 2017; Reddie; Goldblum 2018; Philippe 2014; Costa 2017.





to do more. In short, for the author, the Brazilian position is characterised by an emphasis on nuclear justice and opposition to “double standards” (Kassenova 2014, 4). As can be seen, Brazil has an extensive commitment towards the nuclear non-proliferation regime. Even though the country hasn’t always promptly adopted nuclear treaties, this was not related to discomfort with disarmament and non-proliferation but consisted of a political position against the imbalance of mutual responsibilities and obligations inherent to the treaties (Guimarães 2021).

Since the mid-1970s, Canberra has maintained a leading role within the nuclear non-proliferation regime. Nevertheless, security concerns led to the AUKUS partnership and the reinforcement of Australia’s security and defence ties with the UK and the US. The reasoning behind the Australian choice is primarily the resulting military deterrence against perceived security threats (White 2022). However, AUKUS can lead to exacerbated regional military rivalries, particularly within the fields of nuclear competition (Tilemann 2021). Concerning its position within the nuclear non-proliferation regime, the Australian nuclear submarine programme has not changed Canberra’s defence and support for the regime. Nonetheless, it reinforces doubts about the possibility of Australian support for initiatives such as the TPNW due to the increasing Australian alignment with the two atomic powers of AUKUS. It also risks undermining the South Pacific Nuclear Free Zone and the South East Asian Nuclear Free Zone. Especially for states like Indonesia, AUKUS is seen as another example of providing preferential treatment to a Western state by the hegemonic powers. Moreover, the likely AUKUS employment of HEU in its submarine fleet differentiates Australia’s case from Brazil’s, adding a new layer of proliferation concerns. For example, the dependence of Canberra on HEU undermines the efforts to create a norm against high levels of uranium enrichment, which is one of the main objectives of the Iranian nuclear deal (Tilemann 2021), as well as the motivation to create a Fissile Materials Cut-off Treaty.

This article’s main objective consisted in identifying the consequences of Australia’s acquisition of nuclear-powered submarines and Brazil’s development of a nuclear-powered submarine in the nuclear non-proliferation regime. The major consequences identified are mainly related to naval reactor safeguards issues, nuclear proliferation and reinforcement of inequalities within the NPT — by having NWS aiding a NNWS to acquire nuclear-powered submarines while explicitly denying support to other NNWS. The study concludes that to avoid complications related to safeguards and proliferation of nuclear weapons, if





these two cases are to proceed, these states should consider the development of naval nuclear propulsion safeguards, prioritise activities using LEU instead of HEU, and discuss a future FMCT. Finally, it is important to underscore that nuclear submarine programmes are complex, needing decades to be completed, thus providing a suitable time to address these implications.

References

- Acton, James M. 2021. Why the AUKUS Submarine Deal Is Bad for Nonproliferation — And What to Do About It. Carnegie Endowment for International Peace. Available at: <https://carnegieendowment.org/2021/09/21/why-aukus-submarine-deal-is-bad-for-nonproliferation-and-what-to-do-about-it-pub-85399>. Accessed on 10 July 2022.
- Alvim, Carlos Feu; GOLDEMBERG, José; MAFRA, Olga. 2018. The Denuclearization of Brazil and Argentina. *Journal for Peace and Nuclear Disarmament*, 1, no. 2: 383-403.
- Australia. Department of Defence. 2013. 2013 Defence White Paper. Department of Defence Press.
- Australia. Department of Defence. 2009. Defending Australia in the Asia Pacific Century: Force 2030. Department of Defence Press.
- Australia. Prime Minister Office. 2021a. Joint Leaders Statement on AUKUS. Media Statement. Available at: <https://pmtranscripts.pmc.gov.au/release/transcript-44109> Access on: 5 July 2022.
- Australia. Prime Minister Office. 2021b. Address: AUKUS — Canberra, ACT. Media Statement. Available at: <https://pmtranscripts.pmc.gov.au/release/transcript-43566> Access on: 5 July 2022.
- Bandarra, Leonardo Carvalho Leite Azevedo. A luta contra o Tordesilhas Nuclear: três momentos da política nuclear brasileira (1969-1998). 2016. 198 f. Dissertação (Mestrado em Relações Internacionais) — Programa de Pós-Graduação em Relações Internacionais, Universidade de Brasília, Brasília, 2016.
- Beasley, R.K.; Kaarbo, J. 1999 'A practical guide to the comparative case study method in political psychology', *Political Psychology*, vol. 20, no. 2, pp. 369-391.
- Bezerril, Carlos. 2011. P. Índice de Nacionalização de Produtos de Defesa. In: XI Encontro Nacional de Estudos Estratégicos. Disponível em: <https://pt.slideshare.net/saepr/painel-4-marinhactmspaltebezerril>. Acesso em: 20 jun. 2020.
- Brasil. Conselho Nacional de Segurança. Memorando nº 11, de 21 de fevereiro de 1985. Estrutura do Programa Nuclear Paralelo. Available at: <https://digitalarchive.wilsoncenter.org/document/115216>. Accessed on: 11 July 2022.





- Brasil. 2012. Política Nacional de Defesa e Estratégia Nacional de Defesa.
- Brasil. 2020. Política Nacional de Defesa e Estratégia Nacional de Defesa.
- Botti, Timothy J. 1987. *The Long Wait: The Forging of the Anglo-American Nuclear Alliance, 1945–58*. Contributions in Military Studies. New York: Greenwood Press.
- Carr, Bob. 2023. We've long said no to US. A yes now could be nuclear — Pearls and Irritations. Available on: <https://johnmenadue.com/weve-long-said-no-to-us-a-yes-now-could-be-nuclear/> Accessed on 30 March 2023.
- Mackerras, Colin. 2020. No war with China, cold or hot. Pearls and Irritations. Available on: <https://johnmenadue.com/colin-mackerras-no-war-with-china-cold-or-hot/> Accessed on 30 March 2023.
- Collier, David. 1993. *The Comparative Method*. Berkeley: UC Berkeley Previously Published Works.
- Cormier, Monique. 2022. Implications for the International Legal Regime. In: HANSON, Marianne; ROMULD, Gen. *Troubled Waters: Nuclear Submarines, AUKUS and the NPT*. ICAN Australia.
- Costa, Eugenio Pacelli Lazzarotti Diniz. 2017. Brazil's Nuclear Submarine: A Broader Approach to the Safeguards Issue. *Revista Brasileira de Política Internacional*, 60, no. 2: 1-20.
- Desjardins, Marie-France; Rauf, Tariq. 1998 *Opening Pandora's Box? Nuclear Powered Submarines and the Spread of Nuclear Weapons*, The Canadian Centre for Arms Control and Disarmament, Aurora Papers 8.
- Doherty, Ben. 2022. Australia yet to sign up to treaty banning nuclear weapons but will attend UN meeting as observer. *The Guardian*. Available at: <https://www.theguardian.com/australia-news/2022/jun/20/australia-yet-to-sign-up-to-treaty-banning-nuclear-weapons-but-will-attend-un-meeting-as-observer> Access on: 9 Jun. 2022.
- Doherty, Ben; Hurst, Daniel. 2023. What is the Aukus submarine deal and what does it mean? — the key facts. *The Guardian*. Available at: <https://www.theguardian.com/world/2023/mar/14/what-is-the-aukus-submarine-deal-and-what-does-it-mean-the-key-facts> Access on: 20 May 2023.
- Egel, Naomi; Goldblum, Bethany L; e Suzuki, Erika. 2015. A Novel Framework for Safeguarding Naval Nuclear Material. *The Nonproliferation Review*, 22, no.2: 239-251.
- Gielow, Igor. 2022. Brasil enfrenta resistência a submarino nuclear em agência da ONU. *Folha de São Paulo*. Available at: <https://www1.folha.uol.com.br/mundo/2022/07/brasil-enfrenta-resistencia-a-submarino-nuclear-em-agencia-da-onu.shtml>. Access on: 5 June 2022.
- Guimarães, Victoria Viana Souza. 2021. *O Programa do Submarino de Propulsão Nuclear Brasileiro e o Regime Internacional de Não Proliferação de Armas Nucleares: em busca de compatibilizar dois projetos divergentes*. 233f. Dissertação (Mestrado em





- Estudos Estratégicos) — Programa de Pós-Graduação em Estudos Estratégicos da Defesa e da Segurança, Universidade Federal Fluminense (UFF), Niterói.
- Hanson, Marianne. 2023. “AUKUS: Australia reinforces a neglect of South Pacific and ASEAN neighbours. In *Disarm Korero: AUKUS — the implications for Australia’s neighbours, international law, and regional peace and security*. Webinar hosted by the NZ Disarmament and Security Centre.
- Herz, Monica; Lage, Victor Coutinho. 2013. *A Atual Política Nuclear Brasileira*. Rio de Janeiro: BRICS Policy Center.
- IAEA. International Atomic Energy Agency. 2022. Director General’s Introductory Statement to the Board of Governors. Available at: <https://www.iaea.org/newscenter/statements/iaea-director-generals-introductory-statement-to-the-board-of-governors-6-june-2022>. Access on: 18 June 2022.
- IAEA. International Atomic Energy Agency. 1997. First Accession to Additional Safeguards Protocol. Available at: <https://www.iaea.org/newscenter/pressreleases/first-accession-additional-safeguards-protocol> Access on: 8 July 2022.
- ICAN. International Campaign to Abolish Nuclear Weapons. 2022? The Campaign. ICAN. Available at: https://www.icanw.org/the_campaign Access on: 11 July 2022.
- Jonas, David S.; Carlson, John; Goorevich, Richard S. 2012. The NSG Decision on Sensitive Nuclear Transfer: ABACC and The Additional Protocol. *Arms Control Today*. Available at: <https://www.armscontrol.org/act/2012-11/nsg-decision-sensitive-nuclear-transfers-abacc-additional-protocol>. Access on: 27 July. 2022.
- Kaplow, Jeffrey M. 2017. “NPT’S Naval Nuclear Propulsion Loophole”. In: *Nuclear Rules, Not Just Rights: The NPT Reexamined*. Arlington: Nonproliferation Policy Education Center, 123 — 153.
- Kassenova, Togzhan; FLORENTINO, Lucas Perez; SPEKTOR, Matias. 2020. *Perspectivas para a governança nuclear no Brasil*. São Paulo: Editora FGV.
- Kassenova, Togzhan. 2014. *Brazil’s Nuclear Kaleidoscope: An Evolving Identity*. Washington: Carnegie Endowment for International Peace.
- Keating, Paul. 2023. IN FULL: Former PM Paul Keating criticises AUKUS pact and discusses relations with China | ABC News. Available on: <https://www.youtube.com/watch?v=VmgxAoa1n-8> Accessed on 30 March 2023.
- Kelly, Andrew. 2020. *ANZUS and the Early Cold War: Strategy and Diplomacy Between Australia, New Zealand and the United States, 1945-1956*. Saint Philip Street Press.
- Ma, Chunyan; Hippel, Frank von. 2001. Ending the Production of Highly-Enriched Uranium for Naval Reactors. *Non-Proliferation Review* 8, no. 1: 86-101.
- Martins Filho, João Roberto. 2011. O projeto do submarino nuclear brasileiro. *Contexto Internacional*, 33, no. 2: 277–314.





- Martins Filho, João Roberto. 2014. Visões civis sobre o submarino nuclear brasileiro. *Revista Brasileira de Ciências Sociais*, 29, no. 85: 129-144.
- Menadue, John. 2023. Best of 2022: China has neither the intent nor the capability to attack us — Pearls and Irritations. Available at: <https://johnmenadue.com/best-of-2022-china-has-neither-the-intent-nor-the-capability-to-attack-us/> Accessed on 30 March 2023.
- Ministério da Defesa. Relatório de Gestão do Ministério da Defesa, 2019. 121p. Available at: https://www.gov.br/defesa/ptbr/arquivos/lai/auditoria/ciset/relatorio_de_prestacao_de_contas_do_ministerio_da_defesa_2019.pdf. Access on: 15 fev. 2021.
- Ministério das Relações Exteriores (MRE). 2011. Nota 237 — Grupo de Supridores Nucleares. Available at: <http://www.itamaraty.gov.br/pt-BR/notas-a-imprensa/2652-grupo-de-supridores-nucleares> . Access on: 20 jun. 2020.
- Moltz, James Clay. 2006. Global Submarine Proliferation: Emerging Trends and Problems. *The Nuclear Threat Initiative*.
- Moltz, James Clay. 2005. Special Report: Serious Gaps Emerging in Export Controls on Submarines. *NIS Export Control Observer* (2005): 23-25.
- Moltz, James Clay. 1998. Viewpoint: Closing the NPT Loophole on Exports of Naval Propulsion Reactors. *The Nonproliferation*. 108-114.
- Moura, Carmem Lídia Richter Ribeiro. O Brasil e o Fortalecimento do Sistema de Salvaguardas da Agência Internacional de Energia Atômica: do Acordo Quadripartite ao Protocolo Adicional. 2001, 314f. Tese (Curso de Altos Estudos) — Instituto Rio Branco, Brasília, 2001.
- Norman, Greg. 2022. Pentagon official warns that China is acquiring new weapons five times faster than US. *The New York Post*. Available at: <https://nypost.com/2022/07/08/cameron-holt-warns-china-is-acquiring-new-weapons-five-times-faster-than-us/>. Access on: 11 July 2022.
- Patti, Carlo. 2014. O programa nuclear brasileiro: uma história oral. Rio de Janeiro: Editora FGV, 2014.
- Philippe, Sébastien. 2014. Safeguarding the Military Naval Nuclear Fuel Cycle. *Journal of Nuclear Materials Management*. XLII, no. 3: 40-52.
- Reddie, Andrew W.; Goldblum, Bethany L. 2018. All hands on deck: advancing safeguards for naval nuclear materials. *The Nonproliferation Review*, 1, no 16: 147-162.
- Reynolds, Wayne. 2013. An Astute Choice: Anglo-Australian Cooperation on Nuclear Submarines in Historical Perspective. *Security Challenges*, no. 4: 21-44.
- Reynolds, Wayne. 1998. Rethinking the Joint Project: Australia's Bid for Nuclear Weapons, 1945-1960. Cambridge University Press: *The Historical Journal*, No. 3: 853-873.





- Sá, Andréa de. 2015. Brazil's Nuclear Submarine Program. *The Nonproliferation Review*, Monterey, v. 22, n. 1, p. 3-25.
- Sabbagh, Dan. 2022. Ben Wallace 'wants defence budget lifted to 2.5% of GDP by 2028'. *The Guardian*. Available at: <https://www.theguardian.com/uk-news/2022/jun/27/ben-wallace-wants-defence-budget-lifted-to-25-of-gdp-by-2028> Access on 11 July 2022.
- Shea, Thomas E. 2017. *The Nonproliferation and Disarmament Challenges of Naval Nuclear Propulsion*. Federation of American Scientists, Special Report.
- Silva, Antonio Ruy de Almeida; MOURA, José Augusto Abreu de. 2018. The Long History of Brazil's Nuclear Submarine Program. Blog Post. Available at: <https://www.wilsoncenter.org/publication/us-diplomatic-efforts-stalled-brazils-nuclear-program-1970s>. Access on: 5 June 2021.
- Silva, Marcos Valle Machado da. 2022. "Safeguards and the Nuclear-Powered Submarines of the NNWS: there is no gap, there is a first time". In *X Encontro Brasileiro de Estudos Estratégicos e Relações Internacionais*, Niterói.
- Spektor, Matias. 2017. Prospects for Safe-Guarding Brazil's Naval Nuclear Propulsion Program. Federation of American Scientists. Issue Brief, agosto, 2017.
- Tanter, Richard. 2023. AUKUS — "These are the horrors" — Pearls and Irritations. Available on: <https://johnmenadue.com/these-are-the-horrors-of-aucus/> Accessed on 30 March 2023.
- Tilemann, John. 2021. Nuclear Submarines: Mitigating the Proliferation Impacts. Asia-Pacific Leadership Network. Available at: <https://www.apln.network/projects/aucus/nuclear-submarines-mitigating-the-proliferation-impacts> Access on: 10 July 2022.
- VIDIGAL, Armando Amorim Ferreira. *A evolução do pensamento estratégico: meados da década de 70 até os dias atuais*. Rio de Janeiro: Clube Naval, 2002.
- Von Hippel, Frank. 2019. Mitigating the Threat of Nuclear-Weapon Proliferation via Nuclear-Submarine Programs. *Journal for Peace and Nuclear Disarmament*, 2, no. 1: 133-50.
- Watson, Eloise N. 2020. French vs. Australian nuclear policies: convergences, divergences and avenues for cooperation. *Recherches and Documents No. 19/2020*. Fondation pour la Recherche Stratégique.
- Weltman, John J. 1981. Nuclear Weapons Spread and Australian Policy. *Canberra Papers on Strategy and Defence*. No. 24: 1-39.
- White, Hugh. 2022. *Sleepwalk to War: On Alliance Failure and China Delusions*. Quarterly Essay 86, Melbourne: Schwartz Books Pty. Limited.

