



GLOBAL JOURNAL OF HUMAN-SOCIAL SCIENCE: F  
POLITICAL SCIENCE  
Volume 24 Issue 2 Version 1.0 Year 2024  
Type: Double Blind Peer Reviewed International Research Journal  
Publisher: Global Journals  
Online ISSN: 2249-460X & Print ISSN: 0975-587X

## Nuclear-Powered Submarines and the Global Nuclear Order

By Marcos Valle Machado da Silva

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*Keywords:* global nuclear order. non-proliferation. nuclear-powered submarines.

*GJHSS-F Classification:* FOR Code: 1606



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# Nuclear-Powered Submarines and the Global Nuclear Order

Marcos Valle Machado da Silva

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## I. INTRODUCTION

The issue of nuclear material as fuel for the propulsion of submarines, ships, and other military platforms is not subject to a ban or prohibition of the Treaty on the Non-Proliferation of Nuclear Weapons (NPT). This issue has never been raised as a source of great controversy since the countries operating nuclear-powered submarines are only the five Nuclear-Weapon States (NWS) recognized in the NPT<sup>1</sup>, plus India, which is not a signatory to the NPT. However, with the advancement of the Brazilian nuclear submarine program – albeit with slow progress, Brazil is the only Non-nuclear Weapon State (NNWS) developing an autochthonous conventionally-armed and nuclear-powered submarine, that is, an SSN<sup>2</sup> – and the

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<sup>1</sup> According to Article IX, item 3 of the NPT, “a nuclear-weapon State is one which has manufactured and exploded a nuclear weapon or other nuclear explosive device prior to 1 January 1967”. Therefore, USA, Soviet Union (now Russia), United Kingdom, France and China are the Nuclear-Weapon States recognised by NPT (See UNODA. *NPT, Text of the Treaty*). However, Israel, India, Pakistan, and the Democratic People's Republic of Korea (DPRK) are also Nuclear-Armed States, not recognised by NPT (Author note).

<sup>2</sup> Submarines equivalent to the future Brazilian nuclear-powered submarine are commonly referred to as “Nuclear Attack Submarines.”

announcement that Australia will operate and develop an SSN program, this issue has become a hot spot on the non-proliferation agenda. Furthermore, other countries have stated the intention to develop SSN programs – the Republic of Korea (RoK) and Iran – or have already expressed that will in the past – the Canada case. In addition, some countries – such as Japan – have the technology for this, and due to changes in their regional security environment, they may choose to develop this type of weapon system (Silva 2023).

The issue started taking more space in the non-proliferation agenda from 2008 onwards when the Brazilian nuclear-powered submarine program gained momentum. It appeared to be a lonely Non-nuclear Weapon State initiative to develop an indigenous SSN. In addition, despite being publicized, the program made slow progress and suffered successive postponements. Scheduled to be released in 2023 (Defesanet 2014), this date was changed to 2029 (Brazil 2018, p. 37), and the currently scheduled date became 2033 (Brazil 2023).

However, the Brazilian program opened the door to criticism from the perception that nuclear power for military craft propulsion is a gap in the nuclear weapons non-proliferation regime (see Rockwood, 2017; Thielmann & Hoffman, 2012; and Thielmann & Vergantini, 2013). On the other hand, some (few) voices point out that the issue should not be exaggerated with statements that point to the impossibility of safeguarding the nuclear fuel of an SSN (see Carlson 2021).

Nevertheless, the Australian program raised the discussion on the use of nuclear energy for submarine propulsion by the NNWS to another level of tension in the non-proliferation agenda. Australia – within the framework of the Australia, United Kingdom, and United States of America (AUKUS) strategic partnership – will operate SSNs coming from the United States (USA) and develop an SSN with the support of the United Kingdom (UK).

For example, the American submarines of the *Virginia* class are designated attack submarines (SSN). The French submarines of the *Rubis* class receive the designation of *sous-marins nucléaires d'attaque*. British submarines of the *Astute* and *Trafalgar* classes follow the nomenclature and are also called attack submarines (SSN). This article will respect this designation and use the acronym SSN for future NNWS nuclear-powered submarines (Author note).

It is worth noting that there are no significant differences between the fuel cycles for nuclear material to be used in submarine propulsion reactors and for use in power reactors or even research reactors (Guimarães 2023). The reactors projected for the propulsion of an SSN can use Low Enriched Uranium (LEU), that is, uranium enriched to less than 20%. Even using a degree of enrichment close to this limit and, therefore, well above the degree of enrichment of power reactors (usually between 3 to 5%), SSN reactors could use uranium fuel in an enrichment grade much less than the weapons grade. This is not the case for USA and UK submarines, but it is the case for French submarines and also for the future Brazilian SSN.

In this sense, the case of the future Australian SSN introduced a new variable in this matter. This is because, so far, what is ostensibly known is that these submarines would use USA or UK reactors, and in both cases, the nuclear fuel is Highly Enriched Uranium (HEU) with uranium enriched to more than 90%. In addition, the initial transfer of *Virginia* class SSNs from the U.S. Navy to the Royal Australian Navy is scheduled. These possibilities raise legitimate questions about violations of Articles I and II of the NPT by the USA and the UK as NWS and Australia as NNWS. All these issues can have reflections and impacts on the Global nuclear order. Therefore, in this context, it is worth questioning:

- What are the perceptions of the main actors involved with the issue of nuclear energy use for the propulsion of submarines of NNWS?
- What are the impacts of these perceptions on the global nuclear order?

These research questions are inserted into the issue of nuclear submarine propulsion and its implications for the global nuclear order. Thus, the article may contribute to this debate by highlighting the emerging patterns of positions between states regarding the use of nuclear-powered submarines by NNWS and the possible impacts of these patterns on the global nuclear order.

In this context, it is worth reviewing the lexicon on the central concept of this article, that is, the global nuclear order. This expression has been used since the 1970s (see Mandelbaum 1977). However, since the appearance of this concept, it has been criticized for reasons ranging from lack of precision (Roberts 2007) to lack of academic inquiry and to be something that does not exist. Hornsbury (2015) presented a review of these critics of the concept of global nuclear order and pointed out:

Another explanation for this lack of academic inquiry is the claim that a global nuclear order doesn't exist, or if it does, it is best defined in narrow power politics terms, where nuclear order is simply a set of relations between major powers. This definition, best developed by the realist school of international relations, bases its world view on an

anarchic international system in which the search for security or power drives state behaviour, with little room for norms and institutions (Hornsbury 2015, p. 6).

Nevertheless, the concept of global nuclear order was reinvigorated at the turn of the 21st century when Professor William Walker of the University of St Andrews reignited this debate by arguing that:

There has to be a nuclear order, but that order is much more than a structure of power and a set of deterrent relations, just as it is much more than a security regime rooted in international law. It is a complex edifice founded on instruments of both power and law which is held together by mutual interest and obligation. (Walker 2000, p. 722).

According to Walker, this singular order was designed and encouraged mainly – but not exclusively – by the USA and USSR in the 1960s and 1970s, and encompasses two linked and mutually supportive systems: a managed system of deterrence and a managed system of abstinence (Walker 2000). Walker summarizes these two systems as follows:

- A managed system of deterrence, whereby a recognized set of states would continue using nuclear weapons to prevent war and maintain stability, but in a manner that was increasingly controlled and rule-bound; and
- A managed system of abstinence, whereby other states would give up their sovereign rights to develop, hold and use such weapons in return for economic, security and other benefits. (Walker 2000, p. 706).

Through the deterrence system, the USA and the USSR – and later Russia – managed strategic stability through deterrence and nuclear arms control agreements. According to Walker, this system consists, among other things, of “a set of understandings and practices expressed in the ‘deterrence theories’ and enunciated in nuclear doctrine” of command and control over the nuclear arsenals, in hotlines to communications between the leaders of superpowers in unexpected crises and arms control treaties aiming to increase the strategic stability and to reduce the possibility of a nuclear war (Walker 2000, p. 706).

The system of abstinence involves extended deterrence, security assurances, and the formation of a nuclear weapons non-proliferation regime (Walker 2000). By the system of abstinence, the two superpowers of the Cold War built a nuclear weapons non-proliferation regime in which almost all the existing states agreed not to develop nuclear weapons. This regime is understood here in the Krasner sense as “a set of principles, norms, rules, and procedures” (Krasner 1983, p. 1), and the cornerstone of this Regime is the NPT, which establishes, in practice, two categories of States: the Nuclear Weapon States and the Non-Nuclear Weapon States.

*In this context, another question arises: How could this inherently asymmetric and discriminatory order acquire international legitimacy and become almost universal? The answer is that in the abstinence*

system, the order is regime-based, and its legitimacy rested “heavily upon the notion that the possession of nuclear weapons by the five acknowledged powers was a temporary trust and a trust that could be extended to no other nation-state” (Walker 2000, p. 708). In other words, the legitimacy of the system of abstinence and, consequently, the global nuclear order comes from the perception of the temporary asymmetry of this order. So, it can be inferred that any events that conduct a crystallization of this asymmetry or create a new asymmetry will compromise the system of abstinence and the global nuclear order.

A central point in Walker’s construct is that the two systems exist and operate simultaneously. Nevertheless, Walker further improved his framework regarding the global nuclear order’s concept, structure, and logic. In ‘A Perpetual Menace’ (2011), Walker improved his theoretical framework by pointing out that an international nuclear order operates in the context of two interconnected systems: “a managed system of military engagement with nuclear technology (deterrence plus)” and a “managed system of military/civil abstinence from, and civil engagement with, nuclear technology (non- proliferation plus)” (Walker, 2011, pp. 23-24).

The first system is the realm of the NWS and its alliances. The second system is the realm of the NNWS, and it is oriented towards the non-proliferation of nuclear weapons. According to Walker, three logics drive these two systems: armament, disarmament, and restraint. Both system and logic would be connected by a set of “norms, rules and institutions and its central notion of reciprocal obligations – expressed through and not only through the NPT” (Walker 2011, pp. 5-6 and 24).

The point to be noted is that since 2000, any theoretical framework review regarding the global nuclear order has passed through the construct of William Walker (2000, 2007, 2011). In this sense, Peter Hassner (2007) pointed out an NPT-based order, which emerged over three other potential models: disarmament, a world nuclear government, and a fully nuclear-armed world.

Another view is that the global nuclear order lies beyond the framework of deterrence and non-proliferation and was a tool for the hegemonic dominance of the USA. In a more restricted approach, some scholars focus on the nuclear weapons non-proliferation regime. They point out that the USA underwrote this regime through its hegemon position and stress how the erosion of American leadership may lead to its debacle (see Gibbons 2022).

Central to all these approaches and theoretical frameworks is that they point to the existence of a global nuclear order. However, the explanatory power of each of these theories varies. To sum up, the concept of international nuclear order, as defined by Walker (2011 p. 12), will be adopted for this article.

Concerning the central elements constituting the two systems and three logics of Walker’s theoretical framework, this article focuses on the abstinence system, “the non-proliferation plus.”

It should be noted here that the global nuclear order is under pressure and runs the risk of collapsing due to the new context of valorization of atomic weapons by the NWS and by the threats to use nuclear weapons made by a NWS against an NNWS – made by Russia against Ukraine.

Furthermore, the NWS and the NNWS have different perceptions regarding the global nuclear order. Even the NWS are not unitary regarding this order once they differ in terms of nuclear weapons capabilities (qualitatively and quantitatively) and strategic and military aims to be achieved within the framework of the international nuclear order.

These different perceptions reflect an unprecedented issue within this global nuclear order: the use of nuclear energy to propel NNWS submarines.

In this context and having Walker’s construct as a theoretical basis, this article has as its central argument that the different perceptions regarding the use of nuclear energy for the propulsion of NNWS submarines can lead to a new asymmetry in the system of abstinence in which only a few NNWS would have the blessing for this type of application of nuclear energy. In this sense, a new normative inequality would be in the formation process, in which there would be the “have” and “have-not” users of nuclear energy for the propulsion of submarines.

To seek answers to the proposed research questions and to corroborate the assumption made, the article aims to identify and analyze the perceptions and positions of some selected countries regarding the issue of nuclear energy use for the propulsion of submarines of NNWS, highlighting the contradictions and tensions between the perceptions of these countries and their reflects on the global nuclear order. Thus, the following countries will be the object of the proposed analysis: USA, Russia, UK, France, People’s Republic of China (PRC), Brazil, Australia, and RoK. These countries were selected due to their significant positions on the agenda of the global nuclear order or, in the case of NNWS, their active project for developing and (or) acquiring an SSN or the current interest in starting a program like that.

It is worth noting that the following delimitations were established for this article:

- The reasons for an NNWS to develop, acquire, and operate an SSN will not be discussed.
- The existence of a gap or loophole in the nuclear weapons non-proliferation regime resulting from using nuclear material for submarine propulsion by an NNWS will not be discussed. It was assumed, as a premise, that the provisions of Paragraph 14 of

the International Atomic Energy Agency (IAEA) Comprehensive Safeguards Agreements<sup>3</sup> (CSA) model<sup>4</sup> (INFCIRC/153), as well as Article 13 of the Additional Protocol model (INFCIRC/540), when it was the case, provide the necessary framework for special procedures or subsidiary arrangements that the NNWS will have to negotiate with the IAEA.

## II. PERCEPTIONS AND POSITIONS REGARDING THE ISSUE OF NUCLEAR ENERGY USE FOR THE PROPULSION OF SUBMARINES OF NNWS

As stated in the Introduction, the following countries will be the object of the proposed analysis: USA, Russia, UK, France, PRC, Brazil, Australia, and RoK. This group of countries represents the NNWS with programs, capacity or declared interest in developing and operating an SSN, and the central countries with interests and capacity to influence the programs of these NNWS.

The following analytical axes were adopted to identify which are their respective perceptions and positions on the issue of the development and operation of an SSN by an NNWS, as well as the application of safeguards on this nuclear material:

- If it is understood that it is a right of all NNWS parties to the NPT;
- Opposition (or not) to the use of HEU; and
- Whether the possibility of applying adequate safeguards on this material is perceived as feasible.

As a matter of choice, the following sequence will be adopted for the analysis proposed here: Brazil, Rok, USA, UK, Australia, PRC, Russia, and France.

### a) Brazil

Since the second half of the 1980s, the Brazilian State has opted for the peaceful use of nuclear energy without renouncing the domain of the uranium enrichment cycle, nor the development of nuclear research, as well as its use for energy generation and propulsion of naval assets. The Brazilian Federal Constitution, in Title III, Chapter II, Article 21, item XXIII, determines that the use of nuclear energy is exclusively for peaceful purposes: "All nuclear activity within the national territory shall only be admitted for peaceful purposes and subject to approval by the National Congress" (Brazil 1988).

By the end of the 1990s, Brazil was already inserted into the system of abstinence and the restraint logic. In other words, Brazil was fully inserted in the nuclear weapons non-proliferation regime, becoming a signatory of the following treaties: the Treaty of Tlatelolco, the Quadripartite Agreement<sup>5</sup> (INFCIRC/435), the NPT, the Comprehensive Nuclear-Test-Ban Treaty (CTBT), the Antarctic Treaty, the Outer Space Treaty, and the Seabed Arms Control Treaty. Additionally, the country has been a member of the Nuclear Suppliers Group since April 1996.

Brazil's adherence to the system of abstinence is clear. However, successive Brazilian governments have pointed out that additional measures towards nuclear non-proliferation, on the part of the Brazilian State, should be adopted only in return for significant efforts of NWS nuclear disarmament. The signing of an Additional Protocol to the Brazilian CSA is inserted at this position of the Brazilian State, which has been presented by its diplomatic representatives, and expressed in successive editions of the Brazilian National Defense Strategy (see Brazil 2008, 2012, 2016, and 2020).

Having made these initial considerations about Brazil and the nuclear weapons non-proliferation regime, it is worth observing the content of the CSA signed by the Brazilian State. Through the Quadripartite Agreement (INFCIRC/435), Brazil and Argentina placed all nuclear material and all nuclear activities under the safeguards of the IAEA. The Agreement was based on INFCIRC/153. However, some differences exist between the two documents.

Article 13 of INFCIRC/435 provides that the State Party may decide to use nuclear power for submarine propulsion and shall inform the IAEA of this decision through the Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials (ABACC). After this, the State Party shall negotiate with the IAEA an Arrangement to apply the Special Procedures to the nuclear material used for propulsion. This Arrangement shall contain the period or circumstances during which the Special Procedures shall be applied, and "the Agency shall be kept informed of the total quantity and composition of such material in that State Party and of any export of such material." Furthermore, it is worth

<sup>5</sup> Even before becoming a State Party to the NPT, Brazil had already signed a CSA with the IAEA. This Agreement, known as the Quadripartite Agreement and referred to in the IAEA as INFCIRC/435, was signed in 1991 by Brazil, Argentina, the IAEA, and the Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials (ABACC), coming into force in 1994. It is worth noting that the Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials was created on July 18, 1991, with the signing of the Agreement between Argentina and Brazil for the Exclusively Peaceful Use of Nuclear Energy. The principal mission of ABACC is to guarantee Argentina, Brazil, and the international community that all the existing nuclear materials and facilities in the two countries are being used for exclusively peaceful purposes (see ABACC, *About*).

<sup>3</sup> Under Article III of the NPT, each Non-Nuclear Weapon State is required to conclude a safeguards agreement with the IAEA (Author note).

<sup>4</sup> These CSA follow the framework provided for the *INFCIRC/153/Corr – The Structure And Content Of Agreements Between The Agency And States Required In Connection With The Treaty On The Non-Proliferation of Nuclear Weapons* (see IAEA, *INFCIRC/153/Coor*).

noting that there is no deadline for the negotiation to be concluded with the IAEA, and the IAEA will not have the power to approve or know secret or classified knowledge referring to the nuclear material disciplined in the provisions (see IAEA, *INFCIRC/435*).

The point is that Article 13 of *INFCIRC/435* does not present words such as “withdrawal” or “non-application” of safeguards but rather the application of safeguards through establishing an Arrangement involving Special Procedures of safeguards. Thus, under *INFCIRC/435*, there is no possibility that a State Party (Brazil or Argentina) unilaterally declares that the fissile material related to a nuclear-powered submarine will be excluded from the application of safeguards.

Regarding this issue of safeguards and its right to build an SSN, Brazil also prepared a working paper for discussion at the Tenth Review Conference of the NPT (see United Nations, 2020, *NPT/CONF.2020/WP.71*). The working paper begins with a text informing that the Brazilian State submitted to the secretariat of the IAEA “its initial proposal for Special Procedures to be applied to the nuclear material used in naval nuclear propulsion, pursuant to Article 13 of the Quadripartite Agreement”, which is the Brazilian CSA with the IAEA (see United Nations, 2020, *NPT/CONF.2020/WP.71*). The working paper reinforces that there is no ban or prohibition to the use of nuclear energy for naval propulsion.

The working paper states further that, regarding the Brazilian SSN, *its reactor will use low-enriched uranium*, and “the Brazilian Navy has a long-standing partnership with IAEA for the implementation of safeguards in its nuclear-related facilities, which are the only military facilities in the world subject to IAEA safeguards” (see United Nations, 2020, *NPT/CONF.2020/WP.71*).

Concerning the indigenous nature of the program and the grade of enrichment of the nuclear fuel to the Brazilian SSN, the working paper clears that it will adopt the low-enriched uranium:

7. A long-standing objective pursued by Brazil for many decades, the development of nuclear propulsion is a fully indigenous and autonomous project. The submarine, its nuclear reactor and fuel are being designed, developed, built and assembled in Brazil. It will be a nuclear-powered, conventionally armed vessel. Its reactor will use low-enriched uranium (see United Nations, 2020, *NPT/CONF.2020/WP.71*, highlighted by the author).

Another central point in the working paper is the Brazilian expectation regarding the scope of the Special Procedures to be applied to the nuclear material of the Brazilian nuclear-powered submarine.

20. The consultation process under way between Brazil and IAEA will ensure that such special procedures will be sufficient to enable the Agency to draw the relevant safeguards conclusion on the non-diversion of nuclear material, while protecting sensitive technological and operational parameters related to the nuclear-powered submarine (see United Nations, 2020, *NPT/CONF.2020/WP.71*).

The point to be highlighted is that the Brazilian State makes it clear, through this working paper, that it is part of its obligations to ensure that the Special Procedures under negotiation with the IAEA make it possible to guarantee that no nuclear material will be diverted.

In light of the CSA signed by the Brazilian State, as well as the positions presented by representatives of the Brazilian State, both at the IAEA and at the 10th NPT Review Conference, it can be inferred that:

- Brazil perceives using nuclear energy to propel submarines as a “right” of all NNWS.
- Regarding the use of HEU for the propulsion of the SSN of NNWS, Brazil has already informed the IAEA that it will use LEU as nuclear fuel for its future SSN. However, it did not relinquish the possibility of future use of HEU. Likewise, it does not position itself against its use by other NNWS, including the case of Australia with the SSN-AUKUS. It can, therefore, be inferred that Brazil does not negatively perceive the use of HEU for propulsion submarines of NNWS.
- The Brazilian State perceives the implementation of safeguards to guarantee that nuclear fuel will not be diverted to any prohibited activities as feasible.

Box 1 summarizes the respective perceptions and positions of Brazil on the issue of the development and operation of an SSN by an NNWS, as well as the application of safeguards on this nuclear material, considering the three analytical axes adopted:

- If it is understood that it is a right of all NNWS parties to the NPT;
- Opposition (or not) to the use of HEU; and
- Whether the possibility of applying adequate safeguards on this material is perceived as feasible.

*Box 1:* Brazil: positions and perceptions.

	Right of all NNWS Parties to the NPT			Opposition to the use of HEU			Possibility of applying adequate safeguards		
	Yes	No	Ambiguity	Yes	No	Ambiguity	Yes	No	Ambiguity
Brazil		Yes		No, even having declared that it will use LEU in its future SSN.			Yes		

Source: prepared by the author.

In summary, it can be inferred that the perceptions of the Brazilian State are clear and favorable to the total “right” of the NNWS to use nuclear energy to propel submarines, in line with their commitments assumed under the nuclear weapons non-proliferation regime. There is no evidence that Brazil will oppose itself to the use of HEU as nuclear fuel to SSN of NNWS. It is also possible to infer that there is a clear perception regarding the feasibility of implementing safeguards to guarantee that nuclear nuclear will not diverted from an SSN program to any prohibited activities.

*b) Republic of Korea (RoK)*

The RoK is an exemplary party of the system of abstinence. The country has a CSA in force with the IAEA since 1975 (INFCIRC/236). Besides this, RoK has an Additional Protocol to this CSA in force since 2004. The RoK operates 26 nuclear power reactors, which produce about 30% percent of its electricity (see WNA 2024).

Regarding the intentions and capabilities to start an SSN program, it is worth noting that RoK has built 21 submarines since the early 1990s. When President Moon Jae-in was campaigning for office in 2017, he declared, “It’s time for us to acquire nuclear-powered submarines” (see The New York Times 2021).

According to news published in the Korean press, in September 2020, Kim Hyun-jong, the deputy national security advisor to President Moon Jae-in, visited the USA in August of that year to explain the South Korean government's plan to develop a nuclear-powered submarine and requested the supply of low enriched uranium to nuclear fuel. Kim, however, was met with opposition from Washington. Even though it was said that the USA provided an explanation in principle based on the non-proliferation principles, it is a forewarning of a difficult negotiation between South Korea and the USA regarding the plan (see The Dong-A Ilbo 2020).

In 2020, talking about the projects for the modernization of the RoK Navy, the Defense Ministry said it would build six more submarines, the first three powered by lithium-ion batteries. It did not clarify the power source for the other three 4,000-ton submarines. Nevertheless, Kim Hyun-jong, who was a deputy national security adviser for Mr Moon at the time, said that RoK's next generation of submarines would be nuclear-powered (see The New York Times 2021).

The issue of developing a program to build SSNs by RoK was evident during the campaign for the last presidential election in that country, held in 2022.

The candidate backed by then President Moon Jae-in for the 2022 presidential election, Lee Jae-Myung, said he would persuade the United States to win diplomatic and technology aid to launch nuclear-powered submarines amid renewed calls for building

one in the military and parliament after North Korea test-fired a new missile from a submarine in October 2021.

Lee cited the deal Australia struck under a trilateral security partnership with the USA and UK in September to build its own nuclear-powered submarines. Lee stated at a press conference for Reuters on December 30, 2021, that: “It is absolutely necessary for us to have those subs. They are not weaponised in themselves, and technology transfer is under way to Australia,” he said. “We can definitely convince the United States, and we have to” (see Reuters 2021).

However, Yoon Suk-yeol of the conservative opposition People Power Party was the winning candidate. He said he would prioritize improving RoK's satellite and airborne surveillance against North Korea rather than investing in a nuclear submarine. “I do not think we need it right now,” Mr. Yoon said. (see The New York Times 2021).

Since then, the issue has lost some of its intensity. However, the debate remains active in RoK, and the calls for nuclear-powered submarines persist. Nevertheless, the main obstacle to a hypothetical SSN building program at RoK remains the issue of nuclear fuel. As James Campbell points out:

The biggest obstacle to Seoul's acquisition of a nuclear submarine is nuclear fuel. South Korea does not have an indigenous uranium supply, so it imports most of its fabricated uranium fuel from the United States. South Korea renewed its civilian nuclear cooperative 123 agreement with the United States in 2015. The agreement prohibits the RoK from using U.S.-supplied uranium for any military purpose, but permits Seoul to enrich uranium up to 20 percent for civilian applications, if Washington gives its consent (James Campbell 2021, p. 10).

In light of the statements made by RoK's political leaders:

- It can be inferred that RoK is going through internal debates regarding developing an indigenous SSN. However, this program depends on the approval of the USA, which so far does not seem favorable to its execution. In any case, it can be inferred that the RoK perceives using nuclear energy to propel submarines as a “right”. However, it is unclear whether the perception of this “right” extends to all other NNWS aspiring to develop an SSN.
- Based on the previous talks between the USA and RoK governments regarding the supply of LEU to nuclear fuel, it could be inferred that this will be the choice for the possible future South Korean SSN. However, as is the case of Brazil, the RoK official political leadership does not position itself against using HEU by other NNWS, including the case of Australia with the SSN-AUKUS. Therefore, it can be inferred that RoK does not oppose using HEU for propulsion submarines of NNWS.

– Given the remarkable credential with non-proliferation, it is reasonable to infer that RoK perceives the implementation of safeguards as feasible to guarantee that significant amounts of nuclear material are not diverted to prohibited activities.

Box 2 summarizes the respective perceptions and positions of the RoK on the issue of the development and operation of an SSN by an NNWS, as well as the application of safeguards on this nuclear material, considering the three analytical axes adopted.

Box 2: RoK: positions and perceptions.

	Right of all NNWS Parties to the NPT			Opposition to the use of HEU			Possibility of applying adequate safeguards		
	Yes	No	Ambiguity	Yes	No	Ambiguity	Yes	No	Ambiguity
RoK	Yes in its own case. Ambiguity in other cases.			No, even presenting intentions that will use LEU in its own SSN.			Yes		

Source: prepared by the author.

In summary, perceptions of RoK are still divided internally regarding the development of SSN. However, there appear to be no internal debates about its “right” to use nuclear power to propel submarines, in line with its commitments under the nuclear weapons non-proliferation regime. However, there is ambiguity as to whether the RoK would advocate this for any NNWS aspiring to an SSN development or acquisition program. As in the Brazilian case, there is no evidence that RoK will oppose itself to the use of HEU as nuclear fuel to SSN of NNWS. It is also possible to infer that RoK political leadership see as something feasible the implementation of safeguards to guarantee that significant amounts of nuclear material are not diverted from an SSN program to any prohibited activities.

strategic partnership. After 18 months of understanding between the three AUKUS participants, a pathway to provide Australia with SSN was presented.

According to the Joint Leaders Statement on AUKUS, made on 13 March 2023 by USA President Joe Biden, UK Prime Minister Rishi Sunak, and Australian Prime Minister Anthony Albanese at Naval Base Point Loma in California, the first major initiative of AUKUS was the “historic trilateral decision to support Australia acquiring conventionally-armed, nuclear-powered submarines (SSN)” (see United Kingdom. *Prime Minister’s Office*).

The Statement outlines the phased approach envisaged for the SSN-AUKUS. Box 3 summarizes the three planned phases.

c) USA, UK, and Australia

In September 2021, Australia, the United Kingdom, and the United States announced the AUKUS

Box 3: SSN-AUKUS Phased Approach.

	Action Planned
Phase ONE From 2023	Visit of US Navy and Royal Navy Submarines to Australian Ports. Start of training for Australian submariners on the visiting submarines.
Phase ONE From 2027	Begin forward rotations of US and UK SSN to Australia to accelerate the Royal Australian Navy capabilities (naval personnel, workforce, infrastructure and regulatory system).
Phase TWO From 2030	Intention to sell three (and up to five, if needed) U.S. <i>Virginia</i> class SSN to Australia
Phase THREE Late 2030s	Design of an entirely new SSN class, the SSN-AUKUS. The Royal Navy (UK) will receive the first SSN-AUKUS in the late 2030s.
Phase THREE Late 2040s	The Royal Australian Navy will receive the first SSN-AUKUS (built in Australia) in the early 2040s.
In All Phases	Consultations with the International Atomic Energy Agency to develop a non-proliferation approach regarding building and operating SSN by NNWS.

Source: prepared by the author based on Joint Leaders Statement on AUKUS.

It is also worth noting that in the year before the above-mentioned *Joint Leaders Statement*, the three AUKUS States also prepared a joint working paper for discussion at the Tenth Review Conference of the NPT,

in which they confirm their commitment to providing Australia with a nuclear-powered submarine capability and claim that:



Partners are committed to doing this in a way that meets the highest possible nonproliferation standards including by providing complete, welded power units so that Australia need not conduct uranium enrichment nor fuel fabrication, and are engaging with the IAEA to find a suitable verification approach (see United Nations, 2020, *NPT/CONF.2020/WP.66*).

Regarding USA and UK obligations as NWS, the joint working paper states that:

The United Kingdom and the United States recognize their obligations under the Nuclear Non-Proliferation Treaty (NPT) not to assist any non-nuclear-weapon state to manufacture or otherwise acquire nuclear weapons, and will not provide Australia with any assistance in contravention of our obligations under the NPT (see United Nations, 2020, *NPT/CONF.2020/WP.66*).

The working paper also outlines Australia's position regarding the future operation of nuclear-powered submarines and its current commitments to the NPT:

Naval nuclear propulsion is consistent with Australia's NPT and IAEA safeguards obligations and its obligations under the South Pacific Nuclear Free Zone Treaty. Like the NPT, the IAEA's model agreement for NPT verification, the Comprehensive Safeguards Agreement (CSA-INF/CIRC/153), does not prohibit naval nuclear propulsion activities. INF/CIRC/153 is the basis for most countries' CSAs, including Australia's, and in conjunction with the application of an Additional Protocol (AP), is the IAEA's current highest verification standard (see United Nations, 2020, *NPT/CONF.2020/WP.66*).

Furthermore, the working paper clearly states that Australia will not develop a uranium enrichment program – or reprocessing facilities – nor will it manufacture the fuel elements used in its submarines: “[...] with regard to the nuclear fuel cycle, Australia has made it clear it will not pursue uranium enrichment or reprocessing in relation to this initiative” (see United Nations, 2020, *NPT/CONF.2020/WP.66*).

More recently, on the occasion of the Board of Governors of the IAEA Meeting held in June 2023, the representative of the USA Mission to International Organizations in Vienna – Ian Biggs – declared in his speech:

[...] I have the honour of speaking on behalf of Australia, the United Kingdom, and the United States.

[...] We will pursue a phased approach, which includes the acquisition by Australia of Virginia class submarines in the early 2030s, and the acquisition of a trilaterally developed submarine - the SSN-AUKUS - in the early 2040s.

As we have previously advised, the nuclear fuel for Australia's submarines will be supplied to Australia in complete, welded nuclear power units that will not require refuelling during their lifetime. Australia will not enrich or reprocess nuclear material or fabricate fuel for its naval nuclear propulsion program. [...] (see U.S. Mission to International Organizations in Vienna).

In light of the positions presented by the representatives of the USA and UK, it can be inferred that these two States currently have a convergent perception on the following points:

- They are not against the “right” of the NNWS to use nuclear energy to propel submarines. However, except in the case of Australia, they do not support this type of application of nuclear power by the NNWS. In other words, they are selective in understanding that this is a “right” of all NNWS. This selective support is present even to the most expressive military allies, such as the RoK, an indisputable USA military ally, but which does not have the support of Washington and London for the development of an SSN.
- Regarding the use of HEU for the propulsion of the SSN of NNWS, in the case of Australia, the USA, and the UK have found a way to support this use. However, this perception could be different in the case of other NNWS. For example, think of some hypothetical scenarios. In one of them, Russia or the PRC would support an SSN program by Iran, transferring technology and reactors that use HEU to these SSN. A second scenario would be one in which Russia or the PRC would supply reactors with HEU for the Brazilian SSN program. It is hard to imagine that the USA or the UK would support or remain indifferent to these scenarios.
- The same selectivity seems to apply to the possibility of applying adequate safeguards on this nuclear material. In the case of Australia, the USA and the UK argue that the application of safeguards would be effective. That is, it would minimize any possibility that nuclear material would be diverted to prohibited activities. However, it is hard to imagine Washington and London's security and assertiveness in other cases, such as those presented in the two hypothetical scenarios mentioned above.

Box 4 summarizes the respective perceptions and positions of the USA and the UK on the issue of the development and operation of an SSN by an NNWS, as well as the application of safeguards on this nuclear material, considering the three analytical axes adopted:

Box 4: US and UK: positions and perceptions.

	Right of all NNWS Parties to the NPT			Opposition to the use of HEU			Possibility of applying adequate safeguards		
	Yes	No	Ambiguity	Yes	No	Ambiguity	Yes	No	Ambiguity
USA	Yes, but supports only the SSN-AUKUS			Ambiguity - In some cases maybe No			Ambiguity - In some cases Yes		
UK	Yes, but supports only the SSN-AUKUS			Ambiguity - In some cases maybe No			Ambiguity - In some cases Yes		

Source: prepared by the author.

In summary, the USA and UK positions on the analytical axes selected can be selective and ambiguous, depending on which NNWS will develop or operate an SSN. The perceptions of these two countries regarding using nuclear energy to propel submarines are based on strategic military objectives and not on regulatory and legal issues arising from the nuclear weapons non-proliferation regime.

Concerning Australia, it is clear that the country has an exemplary record of commitment to the system of abstinence and the nuclear weapons non-proliferation regime. The country has a CSA in force with the IAEA since 1974 (INFCIRC/217). Besides this, Australia has an Additional Protocol to this CSA in force since 1997. It is worth noting that Australia has no nuclear power reactors and only one research reactor. In other words, the country has no relevant nuclear infrastructure facilities. Thus, Australia's remarkable engagement with the system of abstinence is an excellent credential to

Box 5 summarizes the perceptions and positions of Australia, considering the three analytical axes adopted.

Box 5: Australia: positions and perceptions.

	Right of all NNWS Parties to the NPT			Opposition to the use of HEU			Possibility of applying adequate safeguards		
	Yes	No	Ambiguity	Yes	No	Ambiguity	Yes	No	Ambiguity
Australia	Yes			Yes in its own case. Ambiguity - In some cases maybe No			Yes		

Source: prepared by the author.

In summary, it can be inferred that the perceptions of the Australian State are favorable to the "right" of an NNWS to use nuclear energy to propel submarines, in line with their commitments under the nuclear weapons non-proliferation regime. Concerning the HEU, there is an ambiguity as to whether Australia would advocate using HEU for all NNWS aspiring to an SSN development or acquisition program.

Similar to the Brazilian and Korean cases, the Australian perception points to the applicability of adequate safeguards on this nuclear material.

d) PRC

Since disclosing the AUKUS strategic partnership, the PRC has expressed vehement opposition to the cooperation on nuclear-powered submarines between the three partners. The PRC's

assure that the fissile material of its future nuclear-powered submarines will be used precisely for submarine propulsion and nothing more. In this context, it can be inferred that:

- Australia perceives using nuclear energy to propel submarines as a "right" of an NNWS once it is not an activity banned or prohibited by the NPT.
- Concerning the use of HEU for the propulsion of SSN of the NNWS, Australia will, so far, use this degree of uranium enrichment in the nuclear fuel of its future SSN. However, whether Australia would support this option for other NNWS aspiring to develop an SSN using HEU in nuclear fuel is unclear.
- The Australian State sees the implementation of safeguards as feasible to ensure that no nuclear material will be diverted to prohibited activities.

criticisms have become more forceful and were also presented in two working papers (WP 29 and WP 50) submitted for discussion at the Tenth Review Conference of the NPT held in New York in August 2022.

In the two working papers, the PRC expresses its opposition to the AUKUS and its concern about the compromise of the NPT and states that nuclear material to be transferred by the USA and the UK to Australia "cannot be effectively safeguarded under the current IAEA safeguards system" (see United Nations, 2020, NPT/CONF.2020/WP.29 and NPT/CONF.2020/WP.50).

In this context, the PRC proposed, in the two working papers, that "a special committee open to all IAEA Member States be established to deliberate on the political, legal and technical issues related to the safeguards on naval nuclear propulsion reactors and



their associated nuclear material" of NNWS (see United Nations, 2020, NPT/CONF.2020/WP.29 and NPT/CONF.2020/WP.50).

It is worth noting that in the same way as the PRC, Indonesia presented a working paper expressing concern on nuclear-powered submarines of NNWS and their possible impacts on the nuclear weapons non-proliferation regime. In an indirect reference to AUKUS, the working paper prepared by Indonesia states that:

Indonesia views any cooperation involving the transfer of nuclear materials and technology for military purposes from nuclear-weapon States to any non-nuclear weapon States as increasing the associated risks and the catastrophic humanitarian and environmental consequences, as well as

navigation risks posed by potential proliferation and conversion of nuclear material to nuclear weapons, particularly highly enriched uranium, in the operational status of nuclear naval propulsion (see United Nations, 2020, NPT/CONF.2020/WP.67).

After the Tenth Review Conference of the NPT, the Chinese delegation in Vienna raised a series of *Questions* and *Commentaries* which expressly argued that the SSN-AUKUS constitutes serious risks of nuclear proliferation in contravention of the object and purpose of the NPT since it violates Articles I and II of the Treaty. Box 6 presents some extracts from these *Questions* and *Commentaries* presented by the Chinese Delegation in Vienna.

**Box 6:** Some extracts from *Questions* and *Commentaries* presented by the Chinese Delegation in Vienna – Part I.

***Commentary I on AUKUS: Original Sin in Transfer of Nuclear-weapon Material (2022-10-06).***

[...] No matter how the nuclear weapon material involved is handled, including being sealed in nuclear submarine power reactors, there is no denying the fact that nuclear weapon material will be transferred illegally from nuclear weapon states to a non-nuclear weapon state [...] (see China. 2022a. *Commentary I*).

***Commentary II: Naval Nuclear Propulsion or Nuclear Proliferation? (2022-10-06).***

[...] The naval nuclear propulsion involved in the AUKUS nuclear submarine cooperation is in essence an act of proliferation in direct violation of Articles I and II of the NPT [...] (see China. 2022b. *Commentary II*).

***Commentary III on AUKUS: the US, UK and Australia Mislead Public Opinion by Playing with Concepts (2022-10-06).***

[...] On the issue of AUKUS nuclear submarine cooperation, the three countries have done their utmost to conceal the true nature of this cooperation and to mislead public opinion by claiming nuclear material sealed in reactors cannot be used directly in nuclear weapons. This is incorrect because the nuclear submarine cooperation envisaged under AUKUS clearly involves the transfer of tons of weapons-grade nuclear material without safeguards from two NWSs to a NNWS [...] (see China. 2022c. *Commentary III*).

***Commentary IV: AUKUS Nuclear Submarine Cooperation is a Breach of Safeguards Obligations (2022-10-06)***

[...] The trilateral nuclear submarine cooperation has never been an issue of safeguards arrangement, but rather a legitimacy issue of whether relevant cooperation involves the illegal transfer of weapons-grade nuclear material. [...] If we permit this now, then any NNWS can follow this precedent to acquire nuclear-weapon material and technology under the pretext of nuclear submarine cooperation. In such an event, the international nuclear non-proliferation system will exist only in name and make a mockery of the safeguards that the international community has worked so hard to put in place for making the planet a place of safety and stability [...] (see China. 2022d. *Commentary IV*).

***Commentary VII on AUKUS: Fire Cannot Be Wrapped up in Paper; Whoever Plays with Fire Will Perish by It. (2022-10-06).***

[...] The AUKUS nuclear submarine cooperation adversely impacts upon global strategic stability, international security order, regional peace and stability as well as the global nuclear non-proliferation regime, and has many other broad and far-reaching negative repercussions. For this reason, it requires a political response from the international and regional security mechanisms [...] (see China. 2022e. *Commentary VII*).

Source: prepared by the author.

On the other hand, one of these *Questions* and one of these *Commentaries* states that, unlike the SSN-AUKUS, programs such as the Brazilian SSN are not perceived in unfavorable ways by the RPC. Box 7 presents some extracts from these *Questions* and

*Commentaries* presented by the Chinese Delegation in Vienna.

**Box 7:** Some extracts from *Questions and Commentaries* presented by the Chinese Delegation in Vienna – Part II.

***Question 4 to the IAEA Director General: Is It Possible to Sever the Subordinate Relationship between the NPT and a CSA (2022-10-07).***

In China's view, Article 14 on exclusions of Australia's CSA does not apply to nuclear proliferation activities. No CSA or AP, as customary international law, can override or contradict, much less challenge the status of the NPT as parent law. [...]. The trilateral cooperation involves the original sin, namely, the transfer of weapons-grade nuclear material from NWSs to a NNWS, which is an outright act of nuclear proliferation. It is fundamentally different from indigenous development of naval nuclear propulsion in countries such as Brazil. The tripartite cooperation not only goes beyond the existing CSAs, but also directly contradicts Articles I and II of the NPT. Therefore, it is misleading to claim that Article 14 of CSA applies to the trilateral cooperation [...] (see China. 2022f. *Question 4 to the Director General*, highlighted by the author).

***Commentary II: Naval Nuclear Propulsion or Nuclear Proliferation? (2022-10-06).***

In stark contrast to the indigenous naval nuclear propulsion programs such as those of Brazil and other countries, the AUKUS partnership, is not a simple matter of indigenous development by a sovereign state of nuclear material used in its military vessels. On the contrary, the AUKUS partnership involves the blatant, direct and illegal transfer, for the first time in history, of tons and tons of nuclear weapon material from two NWS to a NNWS, making it an outright act of nuclear proliferation. These two cases should not be mixed up [...] (see China. 2022b. *Commentary II*, highlighted by the author).

*Source: prepared by the author.*

It is worth noting that even considering the PRC arguments valid, a fundamental question would be in order: If the transfers of the *Virginia* class SSN were canceled and if the submarine to be built in Australia used LEU instead of HEU, would the position of the PRC be changed?

This question was addressed on June 6 and 22, 2023, by the author of this article to the H. E. Ambassador Li Song, The Permanent Representative and Ambassador Plenipotentiary and Extraordinary of the People's Republic of China to the United Nations and other International Organizations in Vienna, Permanent Representative to the United Nations Industrial Development Organization and Permanent Representative to the International Atomic Energy Agency.<sup>6</sup> To date, there has been no response.

Thus, in light of the positions presented by PRC representatives, both at the IAEA and at the last NPT Review Conference, it can be inferred that:

- The PRC is not against the “right” of the NNWS to use nuclear energy to propel submarines. The declarations of its representatives at the IAEA make it clear that the PRC does not see problems with indigenous programs such as the one being carried out in Brazil. However, in the case of Australia with the SSN-AUKUS, the PRC takes the opposite position. In other words, the PRC presents a selective and ambiguous position regarding the understanding that this is a “right of all NNWS.”
- Concerning the use of HEU for the propulsion of an SSN of NNWS, the PRC takes a vehemently contrary position outside, at least in the case where this HEU

is provided by the NWS, as is the case of the SSN-AUKUS.

- The same selectivity applies to adopting adequate safeguards on nuclear fuel. In the case of Australia, the PRC points to the impossibility of guaranteeing that significant amounts of nuclear material were not diverted to prohibited activities. However, in the case of Brazil, for example, the PRC does not present any argument against the possibility that the nuclear material used for submarine propulsion will be effectively safeguarded. Thus, once again, a position of selectivity and ambiguity on the part of the PRC is observed.

<sup>6</sup> The channel used was the formal email (chinamission\_vien@mfa.gov.cn) available on the website of the Representation of the People's Republic of China to the United Nations and other International Organizations in Vienna (Author note).

Box 8 summarizes the perceptions and positions of the PRC, considering the three analytical axes adopted.

Box 8: PRC: positions and perceptions.

	Right of all NNWS Parties to the NPT			Opposition to the use of HEU			Possibility of applying adequate safeguards		
	Yes	No	Ambiguity	Yes	No	Ambiguity	Yes	No	Ambiguity
PRC	Ambiguity - In the SSN-AUKUS, No			Ambiguity - In the SSN-AUKUS, Yes			Ambiguity - In the SSN-AUKUS, No		

Source: prepared by the author.

In summary, the PRC has vehemently opposed Australia's acquisition and future development of an SSN in the context of the AUKUS strategic partnership. On the other hand, for NNWS, far from the PRC, this opposition does not seem to exist. However, it is difficult to imagine the PCR not contesting, in some way, within the nuclear weapons non-proliferation regime, a hypothetical SSN development program by other East or Southeast Asian countries such as, for example, RoK or Japan. In other words, the position of the PRC is selective and ambiguous in the three analytical axes selected. Its perception regarding the use of nuclear energy to propel NNWS submarines is, like that of the USA and the UK, based on strategic military objectives and not on regulatory and legal issues arising from the nuclear weapons non-proliferation regime.

e) *Russia*

Russia's perceptions are more complex to analyze than those of the USA, UK, and PRC, as Russian politicians and diplomatic representatives usually keep a low profile on this issue. Even in the case of SSN-AUKUS, the Russian position has been much less forceful than China's.

The concrete case of Russian support for a program to use nuclear energy to propel submarines is that of India. Russia twice leased an SSN to India, trained Indian Navy crews on its submarines, and may have transferred technology to India's submarine program (see Guimarães 2023). However, it is essential to highlight that India is not a Party to the NPT and, therefore, is not obliged to enter safeguard agreements with the IAEA. In this sense, it is worth noting that India has a Voluntary Safeguards Agreement (VSA) with the IAEA and has an Additional Protocol to this VSA. However, no military application of the use of nuclear energy is contemplated in these agreements with the IAEA.

As far as other SSN programs are concerned, the Russian position is muted. Particularly in the case of Brazil, it was reported in various media that the Brazilian government sought Russian support for its program to develop an SSN. According to the BRICS Information Portal:

On March 16, Brazilian newspaper *Folha de Sao Paulo* reported that, during his "controversial" February trip to Moscow, Brazilian President Jair Bolsonaro asked Russian

President Vladimir Putin to support the country's nuclear submarine project. [...] Bolsonaro did it because Washington had offered to provide such technical help but failed to do so. According to an unnamed military source, during the entire "cooperation" process, the American authorities always asked its counterparts in Brasilia for more information and kept stalling for time and faffing about and so already in 2018 (before Bolsonaro's inauguration) it had become clear to the Brazilian Foreign Service - [...] - that these negotiations would not go anywhere. [...] Thus, initial talks with Moscow started. [...] Flávio Rocha, a Brazilian admiral who is also Secretary of Strategic Affairs for the Presidency, traveled to Moscow at the end of 2021, with a mission to discuss some points pertaining to Russian-Brazilian cooperation in this matter. [...] (see BRICS Information Portal 2022).

However, no statements of Russian support were made regarding the Brazilian program. Nevertheless, keeping this possibility open may be retribution by the Russian government for the Brazilian government's shameful lack of criticism of the Russian war of aggression against Ukraine.

Regarding the AUKUS, Russian President Vladimir Putin has been critical of this program since its public announcement. According to the *Xinhuanet* news agency, Putin declared in October 2021 that the AUKUS strategic partnership harms regional stability: "In my opinion, it is good to be friends with each other, but bad to be friends against someone. This impairs the stability that we all talk about, and we all care about" (see *Xinhuanet* 2021).

As for other statements by representatives of the Russian government, the international media has published a few articles by political leaders in Russia. In March 2023, the *Reuters* agency published an article in which Kremlin spokesman Dmitry Peskov said on AUKUS: "There are a lot of questions here related to the problem of non-proliferation. Here, we need special transparency, and we need to answer the questions that arise." However, according to Reuters, "Peskov did not elaborate on the nature of Russia's concerns" (see Reuters 2023).

In April 2023, *The Diplomat* published an article in which Russia's Deputy Foreign Minister Sergei Ryabkov argued that AUKUS is "a great challenge to the international nuclear non-proliferation regime" (see *The Diplomat* 2023). However, all these declarations need further details from the Russian representatives.



In summary, considering the three analytical axes adopted, it is not possible, at the moment, to infer with any precision Russia's perceptions regarding the use of nuclear energy for the propulsion of NNWS submarines. Except that there is no declared opposition to this type of use of nuclear energy by an NNWS.

Box 9: Russia: positions and perceptions.

	Right of all NNWS Parties to the NPT			Opposition to the use of HEU			Possibility of applying adequate safeguards		
	Yes	No	Ambiguity	Yes	No	Ambiguity	Yes	No	Ambiguity
Russia	Ambiguity	-	no declared opposition		Not inferred			Not inferred	

Source: prepared by the author.

Even though the Russian perception concerning the three analytical axes considered is not inferred, it is clear, in light of the statements made by Russian political leaders, that, as in the case of the USA, UK, and PRC, its perception regarding the use of nuclear energy to propel NNWSs submarines is, based on strategic military objectives and not on regulatory and legal issues arising from the nuclear weapons non-proliferation regime.

f) France

The case of France is similar to that of Russia in the sense that Paris maintains a discreet position regarding the development and operation of SSN by NNWS.

The concrete case of France's open involvement in NNWS's SSN program is that of Brazil. Since 2009, France has been the strategic partner of the leading defense project of the Brazilian State. In that year, a cooperation agreement was signed with the Naval Group for the construction of four conventional submarines (Scorpène®), a new shipyard and operational naval base, and support from the Naval Group in the design and construction of a new class of nuclear-powered submarines, the Brazilian Conventionally-Armed and Nuclear-Powered Submarine.

According to the official Naval Group website:

With an unprecedented Transfer of Technology program at hand, Naval Group undertook a very ambitious program 12

Box 10: France: positions and perceptions.

	Right of all NNWS Parties to the NPT			Opposition to the use of HEU			Possibility of applying adequate safeguards		
	Yes	No	Ambiguity	Yes	No	Ambiguity	Yes	No	Ambiguity
France	Ambiguity	-	no declared opposition		Not inferred			Not inferred	

Source: prepared by the author.

Thus, as in the case of Russia, what can be inferred from the perception of France concerning the use of nuclear energy for the propulsion of NNWS

Thus, Box 9 summarizes the gaps when seeking to highlight Russia's perceptions regarding the use of nuclear energy for the propulsion of NNWS submarines, considering the three analytical axes adopted.

years ago: to support the growth of the Brazilian submarine force. First phase: to help Brazil build and operate four conventional Scorpène® submarines (SBR), in a new shipyard and operational naval base built in Itaguaí for this purpose. Prosub (*Programa Submarino*) also plans for a second phase; support from Naval Group in the design and construction of a new class of nuclear-powered submarines, [...], the second phase aims to develop and build the first Brazilian nuclear-powered submarine [...] and the related infrastructures. [...] A phase for which, in accordance with France's commitment and in compliance with international legislature, Naval Group provides technical assistance to the Brazilian Navy, excluding for the nuclear reactor (see Naval Group).

Regarding official positions on the development of programs like the Brazilian program, France's stance is usually discrete, even in the case of the SSN-AUKUS, which implied the breach of the then-existing contract between France and Australia for constructing submarines that would replace the current Collins class SSK of the Royal Australian Navy.

Thus, Box 10 summarizes the gaps when seeking to highlight France's perceptions regarding the use of nuclear energy for the propulsion of NNWS submarines, considering the three analytical axes adopted in this research.

Furthermore, based on unclear criteria, France can support the development of projects for this type of weapons system in some NNWS.

### III. POSSIBLE IMPACTS ON THE GLOBAL NUCLEAR ORDER

As mentioned in the Introduction of this article, the legitimacy of the system of abstinence and, consequently, of the global nuclear order comes from the perception of the temporary asymmetry of this order. So, any events that conduct a crystallization of this asymmetry or create a new asymmetry will compromise the legitimacy of the system of abstinence and the global nuclear order.

The positions and perceptions resulting from the research carried out and which point to the possible

Box 11 summarizes these actors' perceptions regarding nuclear energy use for the propulsion of submarines of NNWS, considering three analytical axes adopted.

*Box 11: Summary of Positions and Perceptions.*

	Right of all NNWS Parties to the NPT			Opposition to the use of HEU			Possibility of applying adequate safeguards		
	Yes	No	Ambiguity	Yes	No	Ambiguity	Yes	No	Ambiguity
Brazil	Yes			No, even having declared that it will use LEU in its future SSN.			Yes		
RoK	Yes in its own case. Ambiguity in other cases.			No, even presenting intentions that will use LEU in its own SSN.			Yes		
USA	Yes, but supports only the SSN-AUKUS			Ambiguity - In some cases maybe No			Ambiguity - In some cases Yes		
UK	Yes, but supports only the SSN-AUKUS			Ambiguity - In some cases maybe No			Ambiguity - In some cases Yes		
Australia	Yes			Yes in its own case. Ambiguity - In some cases maybe No			Yes		
PRC	Ambiguity - In the SSN-AUKUS, No			Ambiguity - In the SSN-AUKUS, Yes			Ambiguity - In the SSN-AUKUS, No		
Russia	Ambiguity - no declared opposition			Not inferred			Not inferred		
France	Ambiguity - no declared opposition			Not inferred			Not inferred		

*Source: prepared by the author.*

Based on Box 11, it was possible to infer that:

- Only the positions of Brazil and Australia recognize, a priori, as a clear and undisputed right of the NNWS the use of nuclear energy for the propulsion of SSN, in line with their respective CSA (and additional Protocols, when this is the case) in force.
- Only the positions of Brazil and RoK point to the non-questioning and recognition of the possibility of using HEU for naval propulsion by NNWS, even though these two countries expressed the use of LEU in their respective programs.
- The positions of Brazil, RoK, and Australia point, a priori, to a recognition that it is possible to apply adequate safeguards to ensure that there will be no diversion of nuclear fuel for illicit activities in SSN programs.

creation of a new asymmetry in the abstinence system were those that:

- Do not recognize as a clear and undisputed right of the NNWS to use nuclear energy for SSN propulsion in line with their respective CSA (and additional Protocols, when applicable) in force.
- Do not recognize the possibility of using HEU for naval propulsion by NNWS.
- Do not recognize as possible the application of adequate safeguards to guarantee that there will be no diversion of nuclear fuel for illicit activities.
- Present inconsistencies of such an order that point to positions based on strategic military objectives and not on regulatory and legal issues arising from the nuclear weapons non-proliferation regime.

In this sense, the positions and perceptions of Brazil, the RoK, and Australia do not compromise the abstinence system and, consequently, the global nuclear order concerning the use of nuclear energy for the propulsion of submarines. However, RoK is still internally debating the decision to develop a program to build an SSN. Furthermore, this program depends on the approval of the USA, which, so far, does not seem favorable to its execution. In any case, it can be inferred that the RoK perceives using nuclear energy to propel submarines as a "right". However, it is unclear whether this perception of a "right" extends to all other NNWS aspiring to develop an SSN. In this sense, the RoK perceptions and positions do not compromise nor enhance the system of abstinence and the global nuclear order. On the other hand, the perceptions and

positions of the Brazilian and Australian States are clear and favorable to the “right” of the NNWS to use nuclear energy to propel submarines, in line with their commitments under the nuclear weapons non-proliferation regime.

The positions and perceptions of the USA, UK, and PRC present evident contradictions. Furthermore, they placed the three NWS in two antagonistic camps regarding the SSN-AUKUS.

The perception and position of the USA and the UK are selective and ambiguous in the three analytical axes, and no distinctions between these two positions were identified. The USA and UK agree that in the case of the SSN-AUKUS, it is a right of the NNWS to use nuclear energy for naval propulsion, there being no problems with the use of HEU, it being possible to apply safeguards on this nuclear material. In other cases, including that of military allies like the RoK, this perception becomes ambiguous, to put it mildly. Thus, the USA and UK positions and perceptions point to the creation of yet another asymmetry in the system of abstinence and, consequently, compromise the current structure of the global nuclear order.

The PRC has strongly opposed Australia’s acquisition and future development of an SSN in the context of the AUKUS strategic partnership. On the other hand, this opposition does not seem to exist for the NNWS far from the PRC. However, it is difficult to imagine the PCR not contesting, in some form, within the nuclear weapons non-proliferation regime, a hypothetical SSN development program by other East or Southeast Asian countries such as, for example, the RoK or Japan. In summary, the position of the PRC is selective and ambiguous, like that of the USA and the UK. Thus, the PRC’s positions and perceptions point to the creation of yet another asymmetry in the system of abstinence and, consequently, compromise the current structure of the global nuclear order.

Concerning Russia, considering the three analytical axes adopted, it was not possible to infer with precision Moscow’s perceptions regarding the use of nuclear energy for the propulsion of submarines of NNWS. Except that there is no ostensibly declared opposition to this use of nuclear energy by an NNWS.

France’s stance is one of discretion on this issue, even in the case of the SSN-AUKUS, which resulted in the breach of the then-existing contract between France and Australia to construct submarines that would replace the current *Collins* class of the Royal Australian Navy. Thus, as in the case of Russia, what can be inferred from France’s perception regarding the use of nuclear energy for the propulsion of submarines of NNWS, considering the three analytical axes adopted, is that there is no declared opposition to this type of use of nuclear energy. In some cases, France perceives the right to use nuclear energy to propel submarines of an NNWS and may even support the development of

projects for this type of weapons system in some NNWS.

In short, the tendency to create a new asymmetry in the global nuclear order exists and is ostensibly present in the perceptions and positions of at least three central actors in the global nuclear order: the USA, the UK, and the PRC. Thus, creating an asymmetry of States that “can” and “cannot” use nuclear energy to propel naval assets, notably submarines, appears as a tangible possibility. The consequences of this new asymmetry will be reflected in the legitimacy of the abstinence system, which is already eroded by other factors, such as the current context of valorization of atomic weapons by the NWS and by the threats to use nuclear weapons made by Russia against Ukraine.

#### IV. FINAL CONSIDERATIONS

Concerning the NNWS, it was shown that there are also ambiguities in the perceptions and positions of these States. Brazil and Australia’s perceptions support the global nuclear order since their stances defend the right of any NNWS to use nuclear energy following their respective CSA (or additional protocol when applicable) in force. However, there needs to be more clarity as to whether RoK would advocate this for any NNWS aspiring to an SSN development or acquisition program.

The perceptions of three NWS – USA, UK, and PRC – are based on strategic military objectives and the nuclear weapons non-proliferation regime is used by these States in line with these objectives. In this context, these NWS use dual standards in their positions regarding the development and operation of SSN by an NNWS. These dual standards can create a pattern where some countries are coerced or prevented from developing or acquiring this weapon system while others can pursue them with the support of one or more NWS. Such dual standards undermine the global nuclear order, mainly by damaging the system of abstinence.

Concerning Russia and France, it was not possible to infer that their perceptions and positions compress or sustain the system of abstinence.

Finally, it is worth, once again, highlighting the existence of ambiguities, contradictions, and tensions between the perceptions and positions of the NWS. The current tensions between the NWS regarding using nuclear energy for the propulsion of submarines of NNWS are centered on the SSN-AUKUS. This issue puts the USA and UK on a collision path with the PRC.

There are also unclear positions and perceptions among the NWS, as evidenced in the cases of France and Russia. However, considering what has been evidenced regarding the USA, UK, and PRC, it can be inferred that the perception and position of the NWS regarding the use of nuclear energy for the propulsion of submarines are based on strategic military objectives

and not on issues normative and legal provisions resulting from the nuclear weapons non-proliferation regime.

Concerning the NNWS, it was shown that there are ambiguities in the perceptions and positions of these States. Among the NNWS analyzed, Brazil is the one that presents a more precise position, as well as a more transparent and less controversial SSN development program.

In summary, the main impact on the global nuclear order resulting from the use of nuclear energy for the propulsion of NNWS submarines is the ongoing creation of a new asymmetry in the system of abstinence in which only a few NNWS would have the blessing for this type of application of nuclear energy. Some NWS are adopting political and diplomatic ways to prevent what is perceived as a possible proliferation from the NNWS. On the other hand, some NWS view the development of nuclear energy complacently according to who is the NNWS that is developing the kind of use of nuclear power.

In this context, the argument stated in this article appears to be valid since the different perceptions regarding the use of nuclear energy for the propulsion of NNWS submarines can lead to a new normative inequality, in which there would be the “have” and “have-not” users of nuclear energy for the propulsion of submarines.

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