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China's LY-1 Laser Weapon under Protocol IV Certain Conventional Weapons Convention: Legal Implications for Indonesia

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ABSTRACT

The LY-1 laser weapon developed by China raises relevant legal issues within the framework of International Humanitarian Law (IHL), particularly in relation to the application of Protocol IV to the Convention on Certain Conventional Weapons (CCW). This study aims to analyze two issues: first, the extent to which the technical characteristics of China's LY-1 laser weapon may be assessed under the prohibition standards set forth in Protocol IV of the CCW; and second, the legal implications arising from Indonesia's status as a non-party to that instrument. This research employs a normative legal method with a treaty-doctrinal approach, namely an analysis of the authentic text of Protocol IV of the CCW combined with an examination of Article 36 of Additional Protocol I of 1977 as a parameter for the legal review of new weapons. The primary sources consist of treaty texts, official positions of the ICRC, doctrines of international humanitarian law, and publicly available technical specifications. The study identifies two key findings. First, the dual-use nature of the LY-1 system places it within a normative grey area under Article 1 of Protocol IV of the CCW. Applying the ICRC's foreseeable effects approach, permanent blindness may be regarded as a reasonably foreseeable outcome, thereby weakening China's claim that the system is solely intended for anti-sensor purposes. Second, Indonesia's non-state party statusresults in a clear asymmetry of treaty obligations, limiting its legal standing to raise claims within CCW mechanisms, excluding it from normative development processes, and constraining its regional defense diplomacy. This research provides a distinct scholarly contribution by examining the legal consequences of this asymmetry in CCW Protocol IV membership. It compares China, as the developer of the LY-1 laser, with Indonesia, a non-party state.

Keywords: LY-1 Laser Weapon; Protocol IV of the CCW; International Humanitarian Law; Asymmetry of Treaty Obligations; Dual-Use Weapon System.

INTRODUCTION

The emergence of the LY-1 laser weapon developed by China within the armament landscape of Southeast Asia raises urgent legal concerns within the framework of IHL. Laser weapons, as part of the category of directed energy weapons, are defined as systems that employ concentrated electromagnetic energy to incapacitate, damage, injure, or destroy

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enemy equipment, facilities, or personnel.[1] However, the principal legal issue extends beyond mere technical definitions. It concerns two fundamental questions. First, to what extent can the development and characteristics of China's LY-1 laser weapon be assessed as compliant with the prohibition standards established under Protocol IV of the CCW. Second, what are the legal and strategic implications of Indonesia's non-ratification of Protocol IV of the CCW in addressing the development of laser weapon technologies. These two issues constitute the core problems examined in this study.

International concerns regarding the use of laser weapons in armed conflict has persisted for several decades. Since the 1970s, various incidents involving the military use of lasers that resulted in injuries to personnel have underscored the urgency for more stringent legal regulation. The international community has given particular attention to the nature of laser technology, which has the potential to cause disproportionate suffering, especially to the human visual system, which is highly vulnerable to radiation exposure even at low intensity.[2] These concerns subsequently prompted the adoption of Protocol IV to the CCW in 1995 as a preventive response by the international community to the threats posed by laser technology in modern warfare.

Protocol IV to the CCW adopted in 1995 and entering into force in 1998 constitutes a significant development in international humanitarian law.[3] This Protocol establishes a prohibition on laser weapons specifically designed to cause permanent blindness to unenhanced vision, as stipulated in Article 1, and imposes an obligation to take all feasible precautions to avoid permanent and irreversible damage to human eyesight, as provided in Article 2.[4] This instrument serves as a primary benchmark for assessing the legality of the LY-1 system, particularly in determining whether the technical characteristics of the weapon fall within its dual-use capability namely, disabling optical sensors while simultaneously posing a risk to human vision or whether it lies within a legal grey area requiring further interpretation. Concurrently, the provisions set forth in Article 36 of the 1977 Additional Protocol I, mandate a legal review of any new weapons, means, or methods of warfare, also function as a critical parameter in evaluating China's compliance with its international obligations.[5]

The development of the LY-1 laser weapon reflects the acceleration of military modernization driven by directed-energy weapon technologies. Based on the combat effectiveness evaluation framework developed by Shi et al. (2023), tactical laser systems such as LY-1 rely on high-intensity radiation beams as their primary mechanism to disable optical sensors and degrade the adversary's surveillance capabilities in modern warfare.[6] Moreover, such weapons possess a distinctive capability as a "soft-kill" system, neutralizing armored platforms by destroying their sensor components. In extreme cases, their use may result in severe physiological harm,

[1]Nano Sujani and Y.H Yogaswara, "Senjata Energi Terarah: Tinjauan Aksiologis," *Jurnal Filsafat Indonesia* 7, no. 1 (2024): 148, https://doi.org/10.23887/jfi.v7i1.67531

[2]Jin Niu et al., "An Investigation of a Biomimetic Optical System and an Evaluation Model for the Qualitative Analysis of Laser Interference Visual Levels," *Biomimetics* 9, no. 4 (2024): 1–2, https://doi.org/10.3390/biomimetics9040220

[3]United Nations Office for Disarmament Affairs, "The Convention on Certain Conventional Weapons," United Nations Office for Disarmament Affairs, 2025, https://disarmament.unoda.org/en/our-work/conventional-arms/convention-certain-conventional-weapons.

[4]United Nations, "Protocol on Blinding Laser Weapons (Protocol IV to the 1980 Convention)" (1995), https://ihl-databases.icrc.org/en/ihl-treaties/ccw-protocol-iv.

[5]Republik Indonesia. Departemen Kehakiman dan Hak Asasi Manusia, *PROTOKOL TAMBAHAN PADA KONVENSI-KONVENSI JENEWA 12 AGUSTUS 1949 DAN YANG BERHUBUNGAN DENGAN PERLINDUNGAN KORBAN-KORBAN PERTIKAIAN-PERTIKAIAN BERSENJATA INTERNASIONAL (PROTOKOL I) DAN BUKAN INTERNASIONAL (PROTOKOL II)*, *Direktorat Jendral Administrasi Hukum Umum Departemen Kehakiman Dan Hak Asasi Manusia Republik Indonesia* (Jakarta: Direktorat Jenderal Administrasi Hukum Umum, 2003), 48.

[6]Likuan SHI et al., "Agent-Based Effectiveness Evaluation Method and Impact Analysis of Airborne Laser Weapon System in Cooperation Combat," *Chinese Journal of Aeronautics* 36, no. 4 (2023): 442–445, https://doi.org/10.1016/j.cja.2022.11.006

including irreversible ocular injury.[7] This raises significant legal concerns, particularly due to the dual-use characteristics of the system. Although, from a technical perspective, the system is designed to target sensors, the intensity and wavelength employed create a substantial risk of causing permanent blindness to exposed personnel. This condition places the LY-1 within the legal ambiguity of Article 1 of Protocol IV to the CCW thereby rendering this study relevant from both legal and strategic perspectives.

The intensification of strategic competition among major powers, together with rapid advancements in sensor, tracking, and surveillance technologies, has increasingly influenced military dynamics in the Indo-Pacific region. This evolving security environment has, in turn, accelerated the development of non-kinetic capabilities.[8] Within this context, progress in laser system technology is being pursued to maintain operational superiority in a highly competitive technological landscape. These developments have direct implications for Indonesia, which is geographically adjacent to contested maritime areas in the South China Sea and has not ratified Protocol IV CCW. Consequently, Indonesia remains in a legally vulnerable position with regard to the deployment of military laser technologies by regional actors.

Sujani and Yogaswara (2024) have contributed to the development of an axiological framework within the philosophy of defence science, establishing a basis for the ethical assessment of directed-energy weapon technologies. Their study incorporates both teleological and deontological perspectives relevant to the formulation of a code of ethics.[9] Ahmed, Mohsin, and Ali (2021) provide a comprehensive analysis of laser technology and its applications in the defence and military sectors. Their research categorises military laser applications into three principal areas: communications, weapon systems, and navigation, guidance, and control. In addition, the authors examine the development of directed-energy weapons from both technical and operational standpoints.[10] However, neither study addresses the dimension of international law, as their analyses are limited to technical and strategic considerations. The issue of state compliance with international treaty instruments, particularly the disparity in the ratification of the Protocol on Blinding Laser Weapons between developing states and developed states potentially affected by such technologies, remains unexamined. Furthermore, the legal implications arising from imbalances in treaty obligations for states that are not parties to the relevant instruments have not been adequately considered in existing scholarship.

This study addresses a research gap that has not been examined in the two aforementioned works. While Sujani and Yogaswara (2024) established a foundational framework for the ethical evaluation of directed-energy weapons, and Ahmed, Mohsin, and Ali (2021) developed a technical taxonomy of military laser applications, the present study advances the discussion into the domain of international law. The primary focus of this research is a normative legal analysis, specifically assessing the extent to which the development and characteristics of China's LY-1 laser weapon are consistent with the prohibitions set forth in Protocol IV of

[7]Elvira Rosert and Frank Sauer, "How (Not) to Stop the Killer Robots: A Comparative Analysis of Humanitarian Disarmament Campaign Strategies," *Contemporary Security Policy* 42, no. 1 (2021): 10, https://doi.org/10.1080/13523260.2020.1771508

[8]Andrew Futter and Benjamin Zala, "Strategic Non-Nuclear Weapons and the Onset of a Third Nuclear Age," *European Journal of International Security* 6, no. 3 (2021): 260–269, https://doi.org/10.1017/eis.2021.2the world stands on the cusp of a possible Third Nuclear Age where the way that we conceptualise the central dynamics of the nuclear game will change again. This paradigm shift is being driven by the growth and spread of non-nuclear technologies with strategic applications and by a shift in thinking about the sources of nuclear threats and how they should be addressed, primarily, but not solely, in the United States. Recent scholarship has rightly identified a new set of challenges posed by the development of strategic non-nuclear weaponry (SNNW

[9]Sujani and Yogaswara, *Senjata Energi Terarah: Tinjauan Aksiologis*. 146-153.

[10]Syed Affan Ahmed, Mujahid Mohsin, and Syed Muhammad Zubair Ali, "Survey and Technological Analysis of Laser and Its Defense Applications," *Defence Technology* 17, no. 2 (2021): 583–592, https://doi.org/10.1016/j.dt.2020.02.012such as holography, space sciences, spectroscopy, medical sciences, micro and power electronics, industrial engineering, and most distinctively, as directed energy military weapons.

the CCW. In addition, this study evaluates the legal and strategic implications arising from Indonesia's non-ratification of Protocol IV, particularly in the context of the rapid development of laser weapon technologies. Accordingly, this research complements prior ethical and technical analyses and offers an original contribution through a systematic and comprehensive legal assessment.

METHOD

This study employs a normative legal research method with a doctrinal–treaty approach, focusing on the analysis of the authentic text of Protocol IV to the Convention on CCW. The primary legal material consists of the text of Protocol IV CCW, while secondary legal materials include legal doctrines, scholarly journal articles, official views of the International Committee of the Red Cross (ICRC), and the technical specifications of the LY-1 laser weapon. Tertiary legal materials comprise legal dictionaries and encyclopedias. Data collection is conducted through a literature review, and all sources are evaluated hierarchically according to their normative authority in supporting legal arguments. The analytical framework applied to assess the legality of the LY-1 laser weapon encompasses two principal parameters. First, the conformity of the weapon's technical characteristics with the prohibition standards set forth in Article 1 of Protocol IV CCW. Second, the relevance of the obligation to conduct a legal review of new weapons pursuant to Article 36 of the 1977 Additional Protocol I. The analysis is conducted through a qualitative legal method by systematically linking each stage of interpretation to the two research questions. Accordingly, this approach is analytical in nature rather than merely procedural.

ANALYSIS AND DISCUSSION

An Assement on the Development and Characteristics of China's LY-1 Laser Weapon in relation with the Prohibition Standards under Protocol IV of the CCW

Protocol IV defines the scope of its prohibition as applying to laser weapons specifically designed to cause permanent blindness. Accordingly, the determination of the technical classification of such devices constitutes a prerequisite for subsequent legal analysis. LY-1 is a high-energy laser system developed to neutralize and destroy a range of threats, including unmanned aerial vehicles (drones), cruise missiles, and precision-guided munitions, and it also possesses the potential to target satellites in low Earth orbit. In contrast to conventional interception systems, this technology employs a coherent energy beam that propagates at a speed approaching 300,000 kilometers per second, thereby enabling it to engage targets almost instantaneously without following a ballistic trajectory or providing prior warning indications.[11] From a technical perspective, LY-1 satisfies the fundamental definition of a "laser weapon" and, as such, must be subjected to assessment under Protocol IV of the CCW.

The phrase contained in Article 1 of Protocol IV, namely "specifically designed," constitutes the central and most substantive legal debate within this instrument. The interpretation advanced by the ICRC places greater emphasis on the intended use of a device, whereby the assessment does not rely solely on the manufacturer's claims, but also on the actual capabilities of the device that can reasonably be anticipated when it is employed under normal conditions.[12] From the ICRC's perspective, where the normal use of a device can reasonably be expected to

[11]Defence Security Asia, "China Unveils LY-1 Laser Weapon: Game-Changing 'Photon Age' Threat to U.S. and Allies in Indo-Pacific," *Defence Security Asia*, (2025), https://defencesecurityasia.com/en/china-ly1-laser-weapon-modern-warfare-in-do-pacific/.

[12]ICRC, "A GUIDE TO THE LEGAL REVIEW OF NEW WEAPONS, MEANS AND METHOD OF WARFARE" (Geneva, 2006): 11, https://www.icrc.org/sites/default/files/external/doc/en/assets/files/other/icrc_002_0902.pdf.

result in incidental effects such as permanent blindness, such a device meets the threshold of prohibition, irrespective of any official assertion that its intended target is limited to sensors. In line with this view, recent scholarly developments indicate that the assessment of the legality of modern weapons increasingly focuses on their actual effects and inherent risks, rather than solely on their intended purpose or design, particularly in the context of military technologies that produce indirect and difficult-to-predict consequences.[13] Accordingly, China's claim that the LY-1 constitutes an anti-sensor weapon cannot, in itself, serve as a sufficient basis for legal justification or exculpation.

The debate between design intent and foreseeable effect constitutes a dualism of interpretation that has long impeded the consistent application of Protocol IV. The design intent approach maintains that the prohibition applies only where a weapon is explicitly designed by its manufacturer with the primary purpose of causing blindness. Conversely, if blindness arises merely as a secondary or incidental effect of a weapon intended for other functions, such a weapon is considered to fall outside the scope of the prohibition.[14] However, this position is widely regarded as inadequate within humanitarian law scholarship, as it creates a significant loophole susceptible to abuse. In such circumstances, developing States may assert an anti-sensor purpose to evade legal responsibility while continuing to deploy weapons with actual blinding capabilities.

Furthermore, the disparity between the normative framework and operational practice complicates the attribution of responsibility and undermines compliance with the principles of distinction and proportionality.[15] In contrast, the foreseeable effect approach, as endorsed by the ICRC, emphasizes that the physical characteristics of a weapon particularly flux density and wavelengths capable of causing retinal damage must be assessed objectively as primary indicators.[16] In the case of LY-1, these technical parameters demonstrate that permanent blindness constitutes a reasonably foreseeable consequence. Accordingly, the weapon cannot be excluded from the normative scope of Article 1 of Protocol IV of the CCW solely on the basis of claims that its design purpose is limited to anti-sensor functions.

This analysis examines the dual-use nature of the LY-1 system. The term dual-use object refers to an object that possesses the capacity for both civilian and military applications simultaneously.[17] The LY-1 is capable of performing two distinct functions: it can operate as a sensor-disabling device and has the potential to cause permanent injury to human vision. Given that the LY-1 is a high-energy laser system, retinal damage to personnel exposed to its emissions is highly probable. Laser radiation within the wavelength range of 400–1400 nm is recognized as hazardous to the retina, as it encompasses both the visible light spectrum and the near-infrared spectrum. The absence of pain receptors in the retina, combined with the visual system's inability to detect wavelengths above 780 nm, may result in exposure to near-infrared radiation that often goes unnoticed. This condition significantly increases the risk of severe

[13]G. Blair Kuplic and Jonathan Sawmiller, "Humanity on the Final Frontier: Challenges in Applying International Humanitarian Law to Modern Military Space Operations," *International Review of the Red Cross* 107, no. 928 (2025): 232–234, https://doi.org/10.1017/S1816383124000559

[14]United Nations, "Protocol on Blinding Laser Weapons (Protocol IV to the 1980 Convention)," (1995), https://ihl-databases.icrc.org/en/ihl-treaties/ccw-protocol-iv.

[15]Camilla G. Cooper, "Ensuring Lawful Use of Autonomous Weapons," *Journal of International Humanitarian Legal Studies* 15, no. 2 (2024): 317–346, https://doi.org/10.1163/18781527-bja10091

[16]ICRC, "REPORT OF THE INTERNATIONAL COMMITTEE OF THE RED CROSS for the REVIEW CONFERENCE of the 1980 UNITED NATIONS CONVENTION on PROHIBITIONS OR RESTRICTIONS ON THE USE OF CERTAIN CONVENTIONAL WEAPONS WHICH MAY BE DEEMED TO BE EXCESSIVELY INJURIOUS OR TO HAVE IN," *International Committee of the Red Cross*, vol. 68 (Geneva, 1994).

[17]Nadia Azzahra and Lina Hastuti, "Analisis Hukum Humaniter Internasional Terhadap Penyerangan Dual Use Object Dalam Konflik Bersenjata Rusia Dan Ukraina," *Jurist-Diction* 8, no. 1 (2025): 96, https://doi.org/10.20473/jd.v8i1.54375

impairment of visual function, including reduced night vision, disruption of color perception, and permanent blindness.[18]

Technically, lasers with wavelengths below 1.4 μm (micrometer) threshold have the potential to reach the human retina and cause damage.[19] This condition indicates that a single system may produce different consequences depending on its target and the manner in which it is used. Accordingly, this dual-use characteristic places LY-1 within a legally indeterminate area under international law, thereby rendering the assessment of its compliance with Protocol IV of the CCW more complex and requiring heightened caution. Conversely, such circumstances necessitate a more precise legal evaluation in determining its classification and legality. In this regard, the ICRC has emphasized that functional ambiguity in weapons cannot be invoked as a justification to avoid legal review. In light of the rapid advancement of weapons technology, measures must be undertaken to prevent unnecessary suffering.[20] Furthermore, the burden of proving that a system is safe and does not violate applicable legal provisions should remain with the State responsible for its development, rather than with those who question its legality.

Article 2 of Protocol IV on Blinding Laser Weapons obliges each state party to take all feasible precautions to prevent the occurrence of permanent blindness resulting from the use of laser systems that are not otherwise prohibited.[21] In this context, a pertinent question arises as to the extent to which the doctrinal regulation of LY-1 laser system by China complies with this obligation. Based on technical information available in the public domain, there is no sufficient evidence demonstrating the existence of official publications issued by China concerning the operational protocols of the LY-1 that clearly align with the framework established under Protocol IV. This lack of transparency raises a normative concern, considering that the preventive obligation set forth in Article 2 is of an active nature and requires the implementation of concrete, verifiable measures, rather than mere statements or undocumented commitments. Furthermore, limited access to technical data relating to the operational specifications of the LY-1 cannot serve as a valid justification for such ambiguity. On the contrary, this limitation reinforces the indication that China's level of compliance with the provisions of Article 2 of Protocol IV cannot yet be regarded as adequate.

In assessing whether the LY-1 system complies with the provisions of Protocol IV of the CCW, reference may be made to the interpretative guidance developed by the ICRC. Within the framework of international humanitarian law, the evaluation of the legality of a weapon cannot be based solely on the claims of the developing State. Instead, such an assessment must be conducted through an objective mechanism as stipulated in Article 36 of the 1977 Additional Protocol I, which obliges States Parties to determine whether the employment of a weapon is prohibited under applicable legal rules.[22] Based on the preceding explanation concerning its dual-use nature, technical characteristics, and the limited transparency of information regarding the LY-1 system, it can be argued that this laser weapon has not fully satisfied the requirements set forth under Protocol IV of the CCW, particularly when evaluated in light of its reasonably foreseeable effects. On the other hand, China is legally bound to fulfill these obligations. In the absence of sufficient evidence demonstrating that a legal review of the LY-1 system has been

[18]Karolina Bonińska, "Dermatologic Laser-Induced Ocular and Periocular Complications: A Review," *BMC Ophthalmology* 23, no. 419 (2023): 3, https://doi.org/10.1186/s12886-023-03159-x.

[19]Ahmed, Mohsin, and Ali, *Survey and technological analysis of laser and its defense applications*, 588.

[20]ICRC, "Review of New Weapons," International Committee of the Red Cross, (2011), https://www.icrc.org/en/document/review-new-weapons.

[21]United Nations, "Protocol on Blinding Laser Weapons (Protocol IV to the 1980 Convention)," (1995), https://ihl-databases.icrc.org/en/ihl-treaties/ccw-protocol-iv

[22]International Committee and Red Cross, "A Guide to the Legal Review of New Weapons, Means and Methods of Warfare: Measures to Implement Article 36 of Additional Protocol I of 1977," *International Review of the Red Cross* 88, no. 864 (2006): 933, https://doi.org/10.1017/S1816383107000938means and methods of warfare in accordance with Article 36 of Protocol I Additional to the 1949 Geneva Conventions.

conducted in accordance with the standards prescribed in Article 36, the issue extends beyond mere technical classification under Article 1 of Protocol IV, and may also involve a broader risk of non-compliance with international legal obligations.

It must be acknowledged that this legal analysis is conducted under conditions of significant technical data limitations, as the complete operational specifications of the LY-1 laser weapon system are not publicly available. Such limitations constitute a substantial constraint on achieving a fully conclusive assessment. Accordingly, any conclusions drawn remain conditional in nature: if the technical parameters of the LY-1 are found, in clinical practice, to exceed the retinal damage threshold at relevant operational distances, the system may be classified as a weapon inconsistent with the prohibition set forth in Article 1 of Protocol IV to the CCW. This approach is consistent with the perspective of international humanitarian law, which emphasizes that technical uncertainty surrounding a weapons system cannot, in itself, serve as a basis for presuming its legality. Principles such as military necessity do not hold a position that permits them to override or set aside binding positive legal norms. Therefore, any legal assessment must remain grounded in the established rules and principles of international humanitarian law, rather than being influenced by external considerations such as technical uncertainty or the operational characteristics of a given system.[23]

It is essential to undertake a comparative assessment with respect to the development of laser weapons that have previously been subject to evaluation in international forums. Prior to the emergence of the LY-1 system, China had developed the ZM-87 laser weapon, which attracted considerable international attention due to its blinding capacity, deemed to exceed the permissible threshold established under Protocol IV, particularly in its ability to cause permanent visual impairment at distances of approximately three to five kilometres.[24] Subsequently, China declared the cessation of the ZM-87 program following its ratification of Protocol IV in 1998. Nevertheless, the continued development of tactical laser weapons in other forms, including the LY-1, represents a more recent manifestation that raises concerns regarding the consistency of such commitment. From a comparative legal perspective, the practice of the international community demonstrates a tendency to assess state compliance with treaty instruments not solely on the basis of formal declarations, but also by taking into account the relevant state's historical patterns of conduct. In this context, the repeated development of weapon systems possessing similar characteristics may be interpreted as an indication of a lack of good faith, which constitutes a fundamental principle in the performance of treaty obligations.[25]

From the perspective of obligations arising under international treaty law, China's position as a State Party to Protocol IV since 1998 entails clear legal consequences. However, to date, there has been no official publication issued by the Chinese government regarding the outcome of any review conducted pursuant to Article 36 in relation to the LY-1 system. This situation differs from the practice adopted by several States, such as Sweden, Australia, and Norway, which have openly published the results of legal reviews concerning their weapons development as a form of accountability and transparency.[26] The absence of such disclosure cannot, in itself, be construed as evidence of a violation. Nevertheless, this lack of transparency

[23]Ahmad Khalil and S. Anandha Krishna Raj, "Assessing the Legality of Autonomous Weapon Systems: An In-Depth Examination of International Humanitarian Law Principles," *LAW REFORM* 19, no. 2 (2024): 379–380, https://doi.org/10.14710/lr.v19i2.58497

[24]Artemii Bernatskyi and Mykola Sokolovskyi, "History of Military Laser Technology Development in Military Applications," *History of Science and Technology* 12, no. 1 (2022): 96, https://doi.org/10.32703/2415-7422-2022-12-1-88-113an analysis of publicly known knowledge about their historical applications in the leading world countries was conducted.

[25]Syarifatul Fadhilah et al., "Pelanggaran Asas Good Faith Terhadap Perjanjian Nuclear Non-Proliferation Treaty (NPT) Oleh Korea Utara," *Majelis: Jurnal Hukum Indonesia* 2, no. 2 (2025): 61, https://doi.org/10.62383/majelis.v2i2.634which raises legal implications regarding its status and obligations as a party to the treaty.

[26]ICRC, "Legal Review of New Weapons: Scope of the Obligation and Best Practices," International Committee of the Red Cross, (2016), https://blogs.icrc.org/law-and-policy/2016/10/06/legal-review-new-weapons/.

may give rise to questions from the standpoint of international legal norms and has the potential to weaken China's argumentative position in asserting that the LY-1 system fully complies with its international legal obligations.

Accordingly, LY-1 satisfies the qualification criteria as a laser weapon that must be subjected to testing under Protocol IV of the CCW. The term "specifically designed" in Article 1 should be interpreted purposively, by taking into account the foreseeable effects of its use rather than relying solely on the manufacturer's design specifications. Furthermore, the dual-use nature of LY-1 cannot serve as a justification to set aside the obligation to conduct assessments in relation to the applicable prohibitions; instead, it necessitates a higher standard of proof from China as the developing State. On the other hand, the limited transparency concerning preventive measures as required under Article 2, along with the absence of publicly available review reports pursuant to Article 36, indicates a tangible gap in compliance. A more definitive assessment can only be undertaken if comprehensive technical data on LY-1 is made available and can be independently verified by both legal and technical experts with proper authority. Accordingly, LY-1 remains within a legal grey area, and China cannot yet be considered to have fully complied with the standards established under Protocol IV of the CCW in both the development and operational deployment of the system.

Legal and Strategic Implications of Indonesia's Non-Ratification of Protocol IV of the CCW in Addressing the Development of Laser Weapon Technology

In Indonesian treaty law, a state is considered legally bound once it has completed one of the recognized procedures of consent, namely ratification, accession, acceptance, or approval, as stipulated in Law Number 24 of 2000.[27] Ratification of an international treaty does not imply that the treaty automatically has domestic legal effect within Indonesia; rather, it signifies that the treaty is binding upon Indonesia as a state party at the international level.[28] To date, Indonesia has not ratified Protocol IV to the Convention on CCW concerning blinding laser weapons; therefore, in formal terms, Indonesia is not bound by the treaty obligations contained in that instrument.

The direct consequence of this non-party status is that Indonesia does not enjoy the substantive rights guaranteed under Protocol IV, including the right to submit claims regarding violations of the prohibition on blinding laser weapons against other States Parties within the formal framework of the CCW. The absence of treaty obligations places Indonesia in a legally asymmetrical position, as it lacks the standing to legitimately invoke responsibility for the use of laser weapon systems that contravene Protocol IV by States Parties, including China, which ratified the instrument in 1998. This asymmetry becomes increasingly significant in light of the presence of the LY-1 laser weapon system within a region that geographically encompasses maritime and airspace areas directly adjacent to Indonesia's defense jurisdiction.

As a non-party state, Indonesia does not possess full access to the enforcement and verification mechanisms available within the framework of the CCW. This limitation implies that, should an incident involving the use of laser weapons resulting in permanent blindness to Indonesian military personnel occur in the future, Indonesia would lack a strong treaty-based legal foundation to lodge formal protests or pursue diplomatic claims, notwithstanding that such conduct constitutes a violation of human rights.[29] Furthermore, Indonesia does not

[27]Sobar Sukmana et al., "IMPLEMENTASI RATIFIKASI PERJANJIAN INTERNASIONAL DI INDONESIA DALAM PERSPEKTIF HUKUM INTERNASIONAL," *PALAR (Pakuan Law Review)* 11, no. 1 (2025): 69, https://doi.org/10.33751/palar.v11i1.11629

[28]Anisa Aulia, Danial Danial, and Mas Nana Juemena, "Ratifikasi United Nations Convention Against Illicit Traffic in Narcotic and Psychotropic Substances 1988 Terhadap Pemberantasan Peredaran Gelap Narkotika Di Indonesia," *Yustisia Tirtayasa: Jurnal Tugas Akhir* 2, no. 2 (2022): 84, https://doi.org/10.51825/yta.v2i2.14365

[29]Human Rights Watch, "THE ARMS PROJECT," 1996, https://www.hrw.org/reports/1996/WR96/Back-01.htm#P108_30819

participate in deliberations concerning normative and technical developments at meetings of CCW states parties. Consequently, it has no role in shaping interpretative guidelines or additional protocols related to emerging generations of laser weapon technologies. This condition indirectly weakens Indonesia's capacity to influence the formation of international norms aligned with its national defense interests, thereby diminishing its effectiveness in international negotiations and reducing its bargaining position, particularly in the context of regional defense diplomacy.[30] Accordingly, Indonesia's status as a non-party not only restricts its access to protective mechanisms but also excludes it from the legal-political processes that determine the direction of development in international humanitarian law concerning laser weaponry.

The legal uncertainty faced by Indonesia due to its non-ratification of Protocol IV to the CCW becomes increasingly complex when directly associated with the LY-1 laser weapon developed by China. As analyzed in the preceding section, the LY-1 possesses dual-use characteristics that may potentially cause permanent blindness to exposed personnel. Nevertheless, China asserts that the system functions as an anti-sensor weapon that does not fall within the prohibitions established under Protocol IV. For a non-party State such as Indonesia, the legal ambiguity surrounding the status of the LY-1 cannot be addressed through the internal mechanisms of the CCW framework, as Indonesia lacks the legal standing to submit a counterinterpretation within that forum. This condition generates a form of strategic legal uncertainty: should the LY-1 be deployed in an armed conflict within a region involving Indonesian personnel, there would be no treaty-based legal framework that explicitly regulates the rights and obligations of the parties concerning the use of such a weapon.

However, several arguments warrant objective consideration. First, the verification mechanism provided under Protocol IV is inherently limited, as it does not establish an independent supervisory body with the authority to conduct on-site inspections or to enforce compliance by States Parties. Consequently, even States that have ratified the Protocol may, in practice, encounter similar difficulties in substantiating violations and securing effective legal remedies.[31] Second, the ratification of Protocol IV may constrain Indonesia's flexibility in the future development of laser-based defense technologies, given that Article 2 imposes stringent preventive measures governing the use of military laser systems. Third, the implementation costs associated with ratification encompassing the review of weapons-use doctrines, the retraining of personnel, and the establishment of compliance systems would require a substantial allocation of resources. Therefore, these costs must be realistically assessed within the framework of national defense budget planning.

Although the foregoing argument is defensible, a more comprehensive legal analysis demonstrates that the failure to ratify Protocol IV may, in fact, create a more significant legal gap in the long term. Within the framework of international humanitarian law, a State that is not a party to a particular treaty remains bound by norms that have evolved into customary international law, as recognized by the International Court of Justice in the Summary of the Advisory Opinion on the Legality of the Threat or Use of Nuclear Weapons (1996).[32] However, the problem lies in the fact that customary international law does not provide clearly defined mechanisms as established in treaty law, particularly regarding the definition of violations, the attribution of state responsibility, and dispute settlement procedures. In the absence of treaty

[30]Dhesy Arisandielis Kase, "The Influence of International Law on the Formation of National Law in Developing Countries," *Ipso Jure* 2, no. 3 (2025): 22, https://doi.org/10.62872/73dd9825

[31]Valentina Carraro, "Promoting Compliance with Human Rights: The Performance of the United Nations' Universal Periodic Review and Treaty Bodies," *International Studies Quarterly* 63, no. 4 (2019): 1081–1082, https://doi.org/10.1093/isq/sqz078

[32]International Court of Justice, "Summary of the Advisory Opinion of 8 July 1996," (1996), https://www.icj-cij.org/node/103928

obligations, Indonesia's claim to protection against blinding laser weapons can only be based on customary norms, the interpretation of which is far more susceptible to uncertainty. Therefore, it is precisely this legal uncertainty that arises from non-ratification, not from ratification itself.

From the perspective of customary international humanitarian law, the prohibition of weapons that cause superfluous injury or unnecessary suffering has been recognized as a norm binding upon all States, irrespective of their participation in specific treaties. This principle is reflected in Article 35(2) of the 1977 Additional Protocol I and is further reinforced by the 2005 ICRC Study on Customary International Humanitarian Law, which identifies the prohibition of blinding laser weapons as a universally applicable customary norm.[33] However, an important distinction exists between protection derived from customary law and that based on treaty law. The former is general in nature and often difficult to operationalize procedurally, whereas the latter provides more specific claims mechanisms that may be enforced through diplomatic channels or inter-State arbitration. Consequently, although Indonesia may theoretically invoke protection under customary law, its non-party status to Protocol IV weakens its legal position in practical terms when confronted with potential scenarios involving the use of LY-1 in the region. Therefore, the absence of ratification of Protocol IV essentially creates a significant legal gap, as treaty law offers a degree of normative certainty that cannot be fully substituted by customary law, particularly in the context of concrete dispute settlement.

Furthermore, the issue that must be addressed is whether Protocol IV in fact introduces new obligations that did not previously exist, or merely codifies norms that had already attained the status of customary international law. In this regard, an examination of the negotiation history of Protocol IV indicates that the instrument essentially codifies a consensus that had developed among States participating in the CCW Conference since the early 1990s, namely that weapons specifically designed to cause permanent blindness are incompatible with humanitarian principles.[34] Protocol IV also introduces several procedural obligations that were not previously articulated explicitly in customary law, particularly the obligation of prevention as stipulated in Article 2, as well as the obligation to comply with restrictions on the use of laser systems that are not prohibited.[35] On this basis, the ratification of Protocol IV by Indonesia does not merely restate pre-existing obligations, but substantively expands and clarifies the scope of legal protection that may be invoked by Indonesia. This further affirms that ratification carries tangible normative value, rather than constituting a mere diplomatic formality.

Indonesia's non-ratification of Protocol IV and the risks posed by the LY-1 laser weapon are connected through three likely Southeast Asian scenarios. First, in a limited South China Sea conflict involving Indonesia and China, competition grows because the area is a major trade route.[36] Deploying the LY-1 to disable Indonesian optical sensors could injure exposed crew. Without ratification of Protocol IV, Indonesia lacks a solid treaty basis to claim violations against its personnel. Second, in peacekeeping missions involving laser technology, Indonesia's legal standing is weak due to a lack of reciprocal obligations. Third, Indonesia's non-party status to Protocol IV limits regional leadership on laser weapon controls and reduces its ability to lead legal initiatives within ASEAN.

From a strategic perspective, Indonesia's non-ratification of Protocol IV has affected the State's capacity to exercise normative leadership within the Southeast Asian region, particularly in relation to the regulation of conventional weapons. Among ASEAN Member States, only a

[33]Departemen Kehakiman dan Hak Asasi Manusia, *PROTOKOL TAMBAHAN KONVENSI JENEWA 1949*, 48.
[34]United Nations Office for Disarmaments Affairs, "Convention on Certain Conventional Weapons."
[35]United Nations, "Protocol on Blinding Laser Weapons (Protocol IV to the 1980 Convention)."
[36]Hatta Abdi Muhammad, Alva Beriansyah, and Ahmad Baidawi, "The Influence of the South China Sea Conflict on the Security and Defence of the Indonesian State" 2, no. 2 (2024): 156, https://doi.org/https://doi.org/10.55927/ijcs.v2i2.12626

limited number have ratified Protocol IV of the CCW. Consequently, Indonesia has a significant opportunity to fill this leadership gap should it decide to become a party to the instrument. Normative leadership in this context extends beyond the diplomatic sphere; it also contributes to strengthening Indonesia's position in encouraging the development of a collective stance among ASEAN Member States regarding advancements in laser weapon technologies within the region. In the context of accelerated military modernization, particularly in the Indo-Pacific, the establishment of harmonized regional norms on laser weapons may serve as an effective mechanism for preventing the escalation of military technologies.[37] The ratification of Protocol IV should not be regarded merely as a matter of domestic legal policy, but rather as a strategic measure capable of reinforcing Indonesia's position as a normative actor in the region.

The implications of the non-ratification of Protocol IV may also be analyzed from the perspective of the development of Indonesia's national defense technology. In the absence of formal adherence to Protocol IV, Indonesia theoretically retains broader discretion in developing military laser systems. However, such discretion is only apparent, as Indonesia remains bound by customary international humanitarian law prohibiting blinding weapons. Should Indonesia, in the future, intend to develop tactical laser systems for defense purposes, the absence of a clear treaty framework may in fact create legal uncertainty in determining the permissible technical parameters. This includes, for instance, identifying which specifications are legally acceptable and which may potentially constitute a violation of international humanitarian law. As is well understood, a well-defined legal framework functions as a technical guideline for the national defense industry, rather than as an impediment.[38]

Thus, Indonesia's non-ratification of Protocol IV to the CCW creates concrete and measurable legal uncertainty, further intensified by the presence of the LY-1 laser weapon system in the region. Juridically, this results in the loss of treaty-based claims regarding violations of the prohibition on blinding laser weapons, restricted access to CCW verification mechanisms, and a weakened position in shaping regional norms on laser weapon technologies. Strategically, it increases operational vulnerability in conflicts involving LY-1, reduces Indonesia's capacity for normative leadership within ASEAN, and limits its ability to establish legally grounded technical frameworks for national defense technology development. Accordingly, ratification of Protocol IV supported by domestic regulatory harmonization and strengthened implementation capacity constitutes a more advantageous normative option than maintaining non-party status. This policy reflects a proactive legal approach to strengthening Indonesia's position amid evolving weapons technology dynamics.

CONCLUSION

This research yields two interrelated principal findings. First, China's LY-1 laser weapon qualifies as a laser system that must undergo review pursuant to the provisions of Protocol IV of the CCW; however, its legal status remains within a significant grey area. China's assertion that the LY-1 is an anti-sensor weapon cannot automatically exclude the system from the scope of the prohibition under Article 1 of Protocol IV, particularly in light of the "foreseeable effect" approach adopted by the ICRC, which affirms that permanent blindness constitutes a reasonably predictable consequence arising from the system's technical characteristics. Moreover, the dual-use nature of the LY-1 necessitates a higher standard of proof on the part of the developer

[37]Ahmed, Mohsin, and Ali, *Survey and technological analysis of laser and its defense applications,* 586.

[38]Muhammad Iqbal Baiquni et al., "Legal Aspect on Indonesia Military-Industrial Complex to Strengthening Defence Industry Research and Clasterization in Building Independent Defence Industry in Indonesia," *Indonesian Journal of Advocacy and Legal Services* 4, no. 2 (2022): 315–328, https://doi.org/10.15294/ijals.v4i2.61289namely Law no. 16 of 2012 concerning the Defense Industry in realizing the Independence of the National Defense Industry. However, over time the implementation of Law no. 16 of 2012 does not work properly, challenges and problems arise, there are two problems in the National Defense Industry, namely Research and Development (R&D

and cannot serve as a justification for evading legal review. The lack of transparency on the part of China concerning preventive measures as required under Article 2 of Protocol IV, coupled with the absence of any publicly available legal review pursuant to Article 36 of the 1977 Additional Protocol I, demonstrates a clear compliance gap that undermines China's normative position as a State Party to Protocol IV since 1998.

Second, Indonesia's status as a non-party to Protocol IV of the CCW creates a concrete and measurable legal vulnerability, particularly in light of the presence of the LY-1 laser weapon system in the region. The absence of treaty commitment places Indonesia in a legally asymmetrical position, as it lacks an adequate legal basis to submit claims regarding violations of the prohibition on blinding laser weapons within official CCW forums, while simultaneously excluding Indonesia from participation in the process of international norm formation that shapes the development of humanitarian law in the field of laser weaponry. Although Indonesia is, in principle, protected under norms of customary international law, such protection is procedurally non-operational and significantly more susceptible to unfavourable interpretation compared to treaty-based protection. Therefore, the ratification of Protocol IV of the CCW constitutes a normatively advantageous and strategic legal step for Indonesia. It should not be regarded merely as a diplomatic formality, but rather as a proactive legal instrument to strengthen the national legal position, enhance normative leadership capacity at the ASEAN level, and provide a legitimate technical-juridical framework for the future development of national defense technology.

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