



War, law and outer space: pathways to reduce the human cost of military space operations

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Despite the long-term desire of the international community to explore and use outer space for peaceful purposes, space systems have been employed for military purposes since the dawn of the space era. As the role of these systems in military operations during armed conflicts increases, so too does the likelihood of their being targeted, with significant risk of harm to civilians and civilian objects on earth and in space. This is because technology enabled by space systems permeates most aspects of civilian life, making the potential consequences of attacks on space systems a matter of humanitarian concern.

In this post, ICRC Legal Adviser Wen Zhou launches a new series on war, law, and outer space, laying out the potential human cost on civilians of military space operations during armed conflicts, outlining the existing rules regulating and restricting such operations under international law – in particular, international humanitarian law (IHL) – and introducing recommended measures to minimize the risk of civilian harm posed by threats to space systems.

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The military application of technology-enabled by space systems is an integral part of modern-day military operations. To date, armed forces have used space systems in a range of applications, such as: satellite systems for the navigation of military aircraft, precision targeting and weapon systems; telecommunication satellites for global command and control; and remote sensors and other space-based monitoring systems for advance warnings of missile attacks, surveillance, and reconnaissance.

Outer space is becoming increasingly contested as major powers view space as an “operational domain”, put in place dedicated space defense strategies and commands, and take steps to further militarize outer space. A growing number of states are engaged in the development, testing, and deployment of kinetic or non-kinetic “counterspace” capabilities. Current and future threats to space systems include electronic warfare, cyber operations, directed energy operations, and the use of orbit-based and ground-based anti-satellite weapons or other counter-space military capabilities, such as harmful in-orbit rendezvous and proximity operations.

While some space systems are exclusively dedicated to military purposes, many carry out both civilian and military functions and are hence of a “dual-use” nature. This is partly because of the dramatic increase in the launches of new, cheaper, and smaller commercial satellites in recent years, which has hugely expanded their capabilities. With this, the dependency on space systems of essential civilian services is also rapidly increasing.

Today, space systems, particularly navigation, communications and remote-sensing satellites, play an indispensable role in the functioning of critical civilian infrastructure, especially in the energy and communications sectors. These sectors enable the provision of the essential services on which civilians depend, such as food production and supply, water, electricity, health care, sanitation, and waste management.

Satellite services also contribute to every phase of humanitarian operations, from needs assessment to emergency relief delivery, from disaster risk reduction to resilience building in protracted conflicts. Take the ICRC as an example. Communication satellites are widely used for both internet communication and vocal communication in the ICRC’s field operations. Around 10-15% of the ICRC field structures and personnel rely solely on satellite communication. Navigation satellites support logistics and provide low-cost and accurate real-time location tracking for personnel and large equipment necessary for the delivery of humanitarian assistance. Today, approximately 2,600 ICRC field vehicles have installed satellite tracking equipment. Earth observation satellites offer unique information and imagery for emergency mapping, risk assessment, and planning and implementation of humanitarian operations, as the generated imagery may reveal distressed agricultural conditions, impacts on water supplies, or destruction resulting from hostilities.

In the event of an armed conflict between states relying on space systems for their military operations, essential civilian services on earth that depend on space systems would also be put at risk. For example, physical damage or destruction of an adversary’s space objects could generate a large amount of space debris, which could in turn damage or destroy other satellites that support safety-critical and other civilian activity. Likewise, a cyber operation against a satellite system on which essential civilian services rely could disable the targeted satellite temporarily or permanently, resulting in widespread adverse consequences for civilians. Moreover, the large number of dual-use systems in outer space puts the civilian activity they service at high risk, since the system’s military function increases the likelihood of them being targeted.

Existing limits under international law on military operations in or in relation to outer space

It is important to underline that military operations in or in relation to outer space do not occur in a legal vacuum; they are regulated and restricted by existing international law. Despite the longstanding desire of the international community to commit to the “exploration and use of outer space for peaceful purposes” (Preamble, *Outer Space Treaty*), if military operations in or in relation to outer space were nevertheless to be carried out as part of an armed conflict, applicable international law includes the Charter of the United Nations and the relevant rules of customary international law prohibiting the threat or use of force, space law treaties, IHL, and the law of neutrality.

As was articulated in the ICRC’s working paper on “*Constraints under International Law on Military Operations in, or in Relation to, Outer Space during Armed Conflicts*”, the following rules of international law restrict the use of weapons and other military operations in, or in relation to, outer space during armed conflicts, including those designed or expected to disrupt, destroy, physically damage or otherwise disable space systems – whether it be a space component, a ground component or any link between them – in, from, to or through outer space, whether by kinetic or non-kinetic means.

First and foremost, customary and treaty rules prohibit or restrict the choice of weapons, means and methods of warfare that could be placed and/or used in or in relation to outer space, including in the event of an armed conflict:

- The placement in orbit of objects carrying nuclear weapons or other weapons of mass destruction, the installation of such weapons on celestial bodies and the stationing of such weapons in outer space in any other manner is prohibited. (Article IV(1), *Outer Space Treaty*)
- The establishment of military bases, installations and fortifications, the testing of any type of weapons and the conduct of military maneuvers on celestial bodies are forbidden. The moon and other celestial bodies must be used exclusively for peaceful purposes. (Article IV(2), *Outer Space Treaty*)
- Weapons that are by nature indiscriminate, or of a nature to cause superfluous injury or unnecessary suffering, as well as a number of other specific types of weapons, are prohibited. These prohibitions are not limited to the terrestrial domains. (*Rules 70-84*, ICRC Customary IHL Study)
- Military or any other hostile use of environmental modification techniques – namely any technique for changing, through the deliberate manipulation of natural processes, the dynamics, composition or structure of the earth or of outer space – having widespread, long-lasting or severe effects as the means of destruction, damage or injury is prohibited. (Articles I and II, *Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques*)

These rules are particularly relevant if states decide to study, develop, acquire or adopt any new weapon, means or method of warfare in or in relation to space – be it kinetic or not, space-based or ground-based. Indeed, states party to the 1977 First Additional Protocol to the Geneva Conventions are required to review the legality of such a new weapon, means or method of warfare to ensure that its employment would comply with IHL and other relevant rules of international law. All states have an interest in doing so to ensure that their armed forces are capable of conducting hostilities in accordance with their international obligations. (*Article 36*, Additional Protocol I)

Subsequently, IHL constrains military operations conducted in the context of an armed conflict, including those that are carried out in outer space or the effects of which extend to outer space.

IHL rules on the conduct of hostilities aim to protect the civilian population on earth against the effects of military operations in, or in relation to, outer space during armed conflicts. These include notably the principle of distinction (*Article 48*, Additional Protocol I; *Rules 1 and 7*, ICRC Customary IHL Study), the prohibition against indiscriminate and disproportionate attacks (*Article 51*, Additional Protocol I; *Rules 11–14*, ICRC Customary IHL Study), and the obligation to take all feasible precautions in attack (*Article 57*, Additional Protocol I; *Rules 15–21*, ICRC Customary IHL Study).

In the ICRC's view, all these rules apply to, and therefore limit, kinetic and non-kinetic military operations against space systems during armed conflicts, including operations that would disable them without damaging them physically.

These rules are particularly relevant in light of the increasing number of dual-use space objects in orbit, as disrupting the civilian functions of dual-use space objects could disrupt large segments of modern-day societies. If a dual-use satellite had become a military objective during an armed conflict (*Article 52(2)*, Additional Protocol I), when assessing the lawfulness of an attack, all foreseeable direct and indirect incidental harm to civilians and civilian objects in outer space and on earth must be considered – not only with regard to the foreseeable incidental civilian harm to other space objects and persons, but also in terms of the consequences for civilians of impairing the civilian use of that dual-use space object.

Whenever feasible, means and methods of warfare that affect solely parts of the space structure used for military purposes and not the parts used for civilian purposes must be chosen to avoid or at least minimize incidental civilian harm. Furthermore, the risk of creating debris and the cascading threats that debris poses to civilian space objects must also be considered when applying these rules. Kinetic attacks against space objects risk causing far more debris than many other space activities, which might damage or destroy in an unpredictable manner other space objects. All feasible precautions must be taken to avoid, and in any event to minimize, incidental civilian harm, including by choosing whenever feasible a non-debris producing alternative when planning an attack against a military objective in space.

International law, in particular IHL, also affords specific protection to certain objects and persons in armed conflict. For instance, attacking, destroying, removing or rendering useless objects indispensable to the survival of the civilian population, such as foodstuffs, agricultural land, drinking water installations and supplies, and irrigation networks, is prohibited, including through military space operations against space systems critical to the production and maintenance of such objects (*Rule 54*, ICRC Customary IHL Study; *Article 54*, Additional Protocol I; *Article 14*, Additional Protocol II). Specifically protected persons and objects, such as medical personnel, activities and facilities, must be protected and respected at all times, including when carrying out military space operations against those space systems necessary for the protection and functioning of these persons and objects (*Article 12*, Additional Protocol I; *Article 11*, Additional Protocol II; *Rules 25, 28 and 29*, ICRC Customary IHL Study). Other persons and objects specifically protected under international law include astronauts (*Article V*, *Outer Space Treaty*), humanitarian relief personnel and objects, civil-defence organizations, cultural property and the natural environment. Furthermore, particular care must be taken of works and installations containing dangerous forces such as dams, dykes and *nuclear power plants*, including those space systems critical to their safety and maintenance (*Article 56*, Additional Protocol I; *Article 15*, Additional Protocol II; *Rule 42*, ICRC Customary IHL Study).

In addition, all feasible precautions must be taken to protect civilians and civilian objects against the effects of military operations in, or in relation to, outer space, which is an obligation that states must already implement in peacetime (*Article 58*, Additional Protocol I; *Rules 22 to 24*, ICRC Customary IHL Study). Measures that could be considered include physically or technically separating space systems (or parts thereof) that are used for military purposes from civilian ones, and working towards identifying space systems serving specifically protected objects, like hospitals and objects indispensable to the survival of the civilian population. If a space object is exclusively dedicated to civilian use, the state of registry should register it as such, clearly indicating its protected status under IHL (*Article (I)(e)*, *Convention on Registration of Objects Launched into Outer Space*).

Working together to prevent and address the human cost of military space operations

As illustrated above, the disruption, damage or destruction of space systems serving critical civilian infrastructure and/or supporting essential civilian services could have significant human cost on civilians on earth and in space. Based on the current understanding of these consequences, recommendations are needed on how to prevent and mitigate these risks with a focus on, but not limited to, the context of an armed conflict. These can inform debates about the application and possible further development of international law and policies governing outer space.

Most recently the UN General Assembly *Open-Ended Working Group* (OEWG) on “reducing space threats through norms, rules and principles of responsible behaviours” is taking place in Geneva from May 2022 to September 2023, and a new *Group of Governmental Experts* (GGE) on the “prevention of an arms race in outer space” under the UN General Assembly will be convened in November 2023. Furthermore, the *Summit of the Future*, to be held in 2024, will provide an opportunity to agree on multilateral solutions for a better future, including by developing “international norms, rules and principles to address threats to space systems and, on that basis, launch negotiations on a treaty to ensure peace, security and the prevention of an arms race in outer space” (Secretary-General's Our Common Agenda Policy Brief 7: *For All Humanity – The Future of Outer Space Governance*, page 20).

The questions about how existing international law, including IHL, should be interpreted and applied in the context of outer space, have prompted extensive work and discussions in multilateral processes and the development of national policies, doctrines and military manuals, as well as academic initiatives such as the drafting of the *McGill Manual on International Law Applicable to Military Uses of Outer Space* (MILAMOS) and the *Woomera Manual on the International Law of Military Space Activities and Operations*.

The ICRC, for its part, has participated in and contributed its expertise to these processes and initiatives, based on its humanitarian mission and mandate. Most recently, we made five *preliminary recommendations* focusing on measures to minimize the risk of civilian harm posed by threats to space systems, which should be implemented at all times. In our view, states should:

- refrain from conducting or supporting any military operation or other activity designed or expected to disrupt, destroy, physically damage or otherwise disable space systems necessary for the provision of essential civilian services and for the protection and functioning of persons and objects specifically protected under international law;

- whenever feasible, physically or technically separate space systems (including satellites, communication links and ground stations, or parts thereof) that are used for military purposes from civilian ones, particularly with regard to systems necessary for the provision of essential civilian services and for the protection and functioning of persons and objects specifically protected under international law;
- identify, register, mark, announce and/or otherwise indicate those space systems within their jurisdiction or control that are to be spared from the effects of military space operations;
- refrain from developing, testing or using kinetic counter-space capabilities, or conducting other harmful operations against space systems that are designed or expected to create space debris; and
- cooperate to increase the resilience of satellite services for humanitarian relief and emergency response in times of armed conflict and other emergencies.

These first three recommendations aim at ensuring the protection of space systems necessary for essential civilian services and specifically protected persons and objects, the fourth recommendation seeks to mitigate the risks of space debris, and the fifth aims to increase resilience of satellite services for humanitarian relief.

More broadly, the ICRC urges states and militaries to consider the risks of humanitarian consequences if they decide to develop any military space capabilities or use them during armed conflicts. In light of the risks of significant civilian harm, states may decide to set general prohibitions or specific limits with regard to weapons, hostilities or other military operations in or in relation to outer space for a range of reasons, and humanitarian impact should not be missing among them. If new legally binding rules and/or voluntary norms in this regard are to be developed, they must be consistent with and build on and strengthen the existing legal framework, including IHL.

In the coming months, this series will feature contributions from legal, policy and technical experts to raise awareness of the humanitarian consequences of the disruption of space-based critical civilian services, discuss international law regulating the military use of outer space and challenges in the interpretation and application of the law, identify gaps and explore measures to prevent and mitigate the potential human cost of military operations in relation to outer space. We look forward to your active participation and feedback.

Tags: armed conflict, IHL, international humanitarian law, international space law, outer space, rules of war, space operations, space security, space systems

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