



**American
Red Cross**

Int'l Humanitarian Law
Youth Action Campaign

SPACE LAW

**AND THE IMPLICATIONS OF
ARMED CONFLICT IN OUTER SPACE**



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2025 ART AND ESSAY COMPETITION:

Letter from the Team



On behalf of the entire American Red Cross and our International Humanitarian Law (IHL) Program, we are proud to present the top entries from our 2024-2025 Student IHL Art and Essay Competition. With more than 100 armed conflicts currently raging around the world in places like Ukraine, Israel and Gaza, Yemen, and beyond, the role of IHL in helping to reduce suffering during wartime remains center stage in the global conscience. For more than a century, IHL has played a central role in helping preserve humanity during our darkest hours. Public awareness, appreciation, and support for these laws is equally vital. It is in this spirit that we annually host our annual IHL Art and Essay Competition.

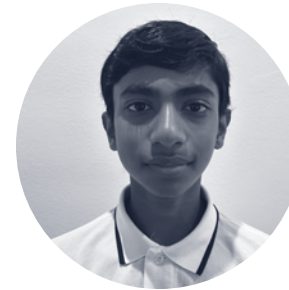
Each year, entrants are challenged to craft compelling essays and artistic creations to reflect the importance of IHL in reducing suffering during conflict. This year, entrants were asked to shape their work around the theme of "Space Law and Armed Conflict," which has been the centerpiece of our global IHL Youth Action Campaign (YAC). This year, more than 1,500 youth IHL Advocates have learned more about the laws that govern and protect outer space, as well as the ways in which international law protects civilians in the context. These IHL Advocates transform their knowledge into public education campaigns, helping teach their peers, families, and communities about IHL. The IHL Youth Essay and Art Competition is a key part of our youth outreach efforts, empowering young professionals from inside and outside the American Red Cross to help highlight the importance of these laws in protecting humanity.

We received a record number of entries this year, making the task of selecting top entries an incredibly difficult one. The entries in this magazine reflect the talent and dedication of young professionals in educating others about the importance of IHL today and in the future. We are excited to share their work widely and celebrate the hard work that went into each entry. May their passionate work inspire you to be a champion for IHL and its humanitarian aims.

Warm regards,

Thomas L. Harper
Senior Counsel, International Humanitarian Law

Photo, from left: Thomas Harper, Senior Counsel, Ashley Sheehy, Youth Action Campaign Lead, Christian Jorgensen, Legal Counsel



FIRST PLACE: ESSAY

IHL: Interstellar Protection

Pratyush Sathish Kumar
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Innovation is a concept deeply ingrained in human history, symbolizing growth and advancement, particularly in the realm of space travel. However, innovation has repeatedly shown humans that there is always a darker side in need of regulation. One such aspect of human innovation in need of restriction is space travel. Over half a century ago, governments funded their top minds and resources to send humans into space and onto the moon. Today, various private companies are competing to exploit outer space, aiming to offer tourism adventures and expand their boundaries onto celestial bodies. However, this progress brings significant dangers. Our communication, GPS, and weather forecasting systems depend on satellites. Private companies in the space sector intensify global warming with toxic fumes that their rockets emit during launches. Each launch also contributes substantial debris to orbit, posing risks to Earth. Nevertheless, the international community has anticipated these dangers and implemented regulations to protect Earth's inhabitants from potentially hazardous situations.

Despite numerous precautions, modern space travel still presents many dangers. The increasing human presence beyond Earth's boundaries poses significant risks. Firstly, space debris is a major concern due to its growing volume and potential impact. "Approximately 11,000 satellites have been launched, with 7,000 remaining in space..." (Suri). This surge in space exploration has drastically increased

the amount of debris in orbit, which is dangerous due to its capabilities. "Just as worrying are satellite re-entries from the mega-constellations, which could deposit hazardous levels of alumina into the upper atmosphere" (Suri). In simpler terms, space debris could re-enter the atmosphere as dangerous projectiles. When this debris inevitably burns up, it releases hazardous gases that accelerate global warming. Rocket launches have a similar effect due to their propulsion engines. Additionally, there is the concern of countries gaining military advantages over others, with world powers fearing that their enemies could dominate space and its celestial bodies or even plan attacks. The expansion of space travel over time has had many worrying consequences and continues to pose significant dangers. With foresight stemming from the worry of many, the international community has established laws to curb the precarious nature of nationalism's potential growth in the boundless field of space. According to the United Nations Office for Outer Space Affairs, "States shall not place nuclear weapons or other weapons of mass destruction in orbit or on celestial bodies or station them in outer space in any other manner" (United Nations Office for Outer Space Affairs). The Outer Space Treaty is one of the most powerful forms of International Humanitarian Law (IHL) because it ensures that no weapons or harmful objects can be in orbit, making it impossible for attacks on a community from outer space. The treaty also requires any advancements

made by one country to be shared with other interested countries to advance humanity collectively.

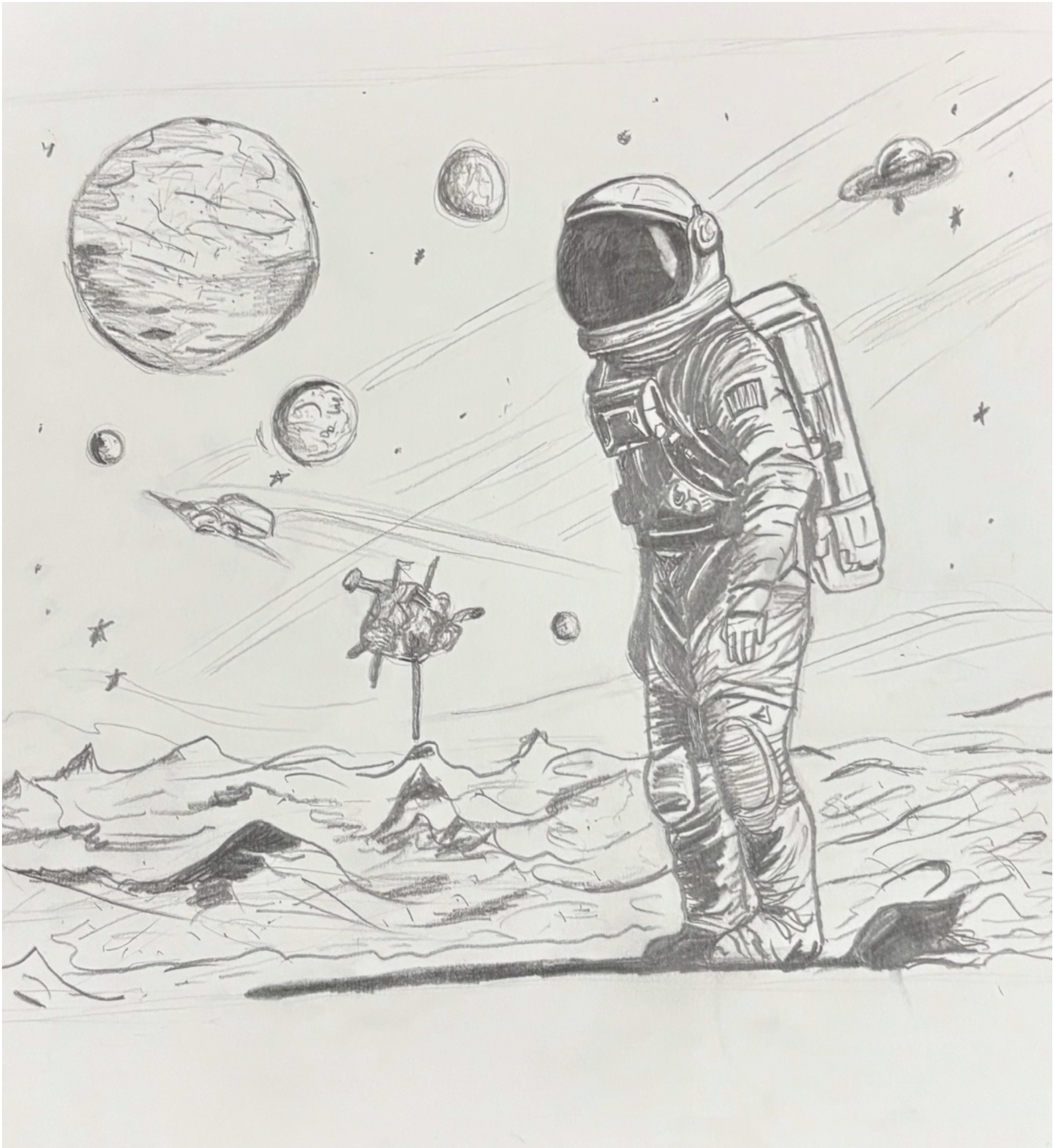
Even without armed conflict or weapons in orbit, the use of satellites and celestial bodies could be abused to harm humans. The Moon Agreement, signed in 1979 and adopted by countries worldwide in 1984, is another significant treaty that protects us from armed conflict. According to the Official Moon Agreement, "It is likewise prohibited to use the moon in order to commit any such act or to engage in any such threat in relation to the earth, the moon, spacecraft, the personnel of spacecraft or manufactured space objects." (UNOOSA). This crucial act, ratified by the United Nations, prevents governments from using harmful technology derived from space. Although the Outer Space Treaty banned weapons in space, it did not address the use of astronomical objects. Before the Moon Agreement, countries could use outer space to create powerful weapons, which was a primary motivation for space exploration. Additionally, there was no protection for satellites. The global concern was: What would happen if a country disabled a satellite, putting another country and its people at a standstill? The Moon Agreement ensures that outer space is used for peaceful exploration rather than militaristic expansion. These treaties, which have safeguarded us for decades, highlight how IHL has protected humanity's right to safety amid the growing expansion of space technology.

Despite the success of IHL, pioneered by organizations such as the International Committee of the Red Cross and the United Nations, today's fast-paced world presents new challenges. The international community systematically placed precautions for government programs. However, today's technology is advancing at an unprecedented rate. Private companies, led by wealthy visionaries, often surpass government standards and are not bound by IHL restrictions. While IHL quires government transparency, private companies can choose how much to disclose and are not subject to laws that restrict space exploitation. There is also the concern that governments might use private companies for weapon advancements otherwise restricted by IHL. "The development of directed energy weapons, such as lasers or microwave-based systems, has been explored by defense contractors like Lockheed Martin and Northrop Grumman" (palmajs). This reality underscores the need for further IHL to secure humanity from private companies that could act as tools for governments, steering peaceful space exploration down a dangerous path. To sum up, the rapid advancement of private companies beyond Earth's exosphere needs to be regulated by IHL to prevent the real dangers of armed conflict stemming from space exploration.

Given these concerns and successes, ongoing global conversations aim to establish IHL today. The United Nations Office for Outer Space Affairs is continually updated on space-related projects, as required. Ongoing meetings with world powers aim to establish new environmentally safe regulations. The Artemis Accords of 2020 reinforced that all actions in space must be peaceful, applying to private companies as well. The International Committee of the Red Cross (ICRC) publishes annual reports on how IHL has been applied to various government corporations and

space ventures, highlighting violations or shortcomings. This transparency allows the international community to assess the next steps to protect public interests regarding peaceful exploration rather than armed conflict. Numerous ongoing practices ensure that private companies and government organizations remain transparent with the global population, and world leaders frequently discuss making safety the top priority in any Outer-Space progress. In conclusion, while the dangers of armed conflict have evolved, the international community's active response to implement IHL has been equally efficient.

To recapitulate, space travel has captivated humanity for years. Countries began exploring with the notion of an arms race, and these thoughts have persisted as global problems grew. International Humanitarian Law was established to protect the rights of Earth and the environment. Even today, there are various ways that space exploration could be misused, but IHL is continually applied to counter the omnipresent risks of innovation. Ultimately, space exploration has the potential for misuse, which could harm Earth and its inhabitants. However, IHL has instituted and will continue to initiate new ways to ensure that innovation serves the greater good in space over armed conflict. ■



FIRST PLACE: ART

Orbiting Eternity

Tanush Patel
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Picture a drawing of an astronaut floating in space, surrounded by pieces of broken satellites and debris. This image shows the connection between Space Law and international law regarding armed conflict. It highlights concerns about the military use of space. Space Law, guided by treaties like the Outer Space Treaty, stops using weapons of mass destruction in space and supports peaceful exploration. However, as technology advances and we rely more on space for communication, navigation, and surveillance, the risk of armed conflict in space increases. The astronaut in the drawing represents our hope for peaceful exploration and the vulnerability of space assets amidst potential space warfare. This drawing shows these major reasons because debris is shown and the devastation destruction military weapons can do in space. We can see a ship, meaning the exploration of space and human advancement. This ship or jet can also mean the use of military weapons. This image emphasizes the weakness of international agreements and the urgent need for legal frameworks

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“IHL is important because it protects civilians, humanitarian, and medical workers during armed conflicts.”



RUNNER UP: ESSAY

IHL Protections and Improvements in Outer Space

Gianna Dusi
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International humanitarian law(IHL) is a set of rules that tries to limit the effects of armed conflict. IHL is known as “the law of war.” It limits the acts of parties engaged in armed conflict. The IHL rules apply during armed conflict on Earth and outer space. The types of space conflict can occur entirely in space, spaced-based with ground effects, or ground to space. IHL is important because it protects civilians, humanitarian, and medical workers during armed conflicts. IHL includes many protections, but it is missing a few key components.

Many protections exist in the use of outer space in armed conflict. One of these protections is distinction. This means you can not attack things like satellites used for peaceful reasons because they are not part of the war. The second principle is proportionality. The proportionally principle states that an attack is prohibited if that expected harm to civilians is excessive in relation to the anticipated gain. The third principle is environmental protection. This states that space should be protected from unnecessary harm. The fourth principle is neutrality

which says that countries not involved in the war should not be attacked. The fifth principle is space debris which means parties must avoid creating dangerous space debris. The sixth principle and final principle is the Outer Space Treaty. The Outer Space Treaty says that weapons of mass destruction can not be placed in space. Even though these six principles exist, many protections are still lacking.

One protection that is lacking is clear rules on what qualifies as a military target in space. For example, what would a satellite be classified as if it was being used for both military and civilian purposes. Another protection that is lacking involves space debris protection. Improved guidelines could be out in place to limit acts that unnecessarily add to the risk of debris. Another protection that needs improvement would be adding safeguards for non military satellites and protecting astronauts in space. The IHL use of outer space in armed conflict does have many protections, but these protections do need to be clarified more and additional protections need to be added to provide a safer world for everyone. ■



RUNNER UP: ART

Peace in War: Protecting Humanity in Armed Conflicts on Earth, in Space, and Beyond

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The picture shows the difference between war and peace divided by an invisible line. It tells us that peace should be maintained even on Earth or in space. On the left side of the illustration, it illustrates a war and depicts a tank, weapons, armed soldier, and an atmosphere-filled smoke, representing disagreement and damage that may affect Earth and extend to space. On the right side, the picture illustrates a peaceful atmosphere filled with rainbows and doves. Also, the image depicts peace through the Greek goddess of peace Eirene, who carries a shield with a Red Cross symbol to represent the International Humanitarian Law. The International Humanitarian Law protects Earth and space from conflicts that might harm humanity. By following the right set of rules, nations, and organizations will ensure that space is explored peacefully and avoid destructive events such as war or armed conflicts against humanity, earth, and space. ■



FIRST PLACE: ESSAY

Defending Space: Legal Challenges in the Militarization of Space

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Introduction
When we look at the stars, we see not just a place of wonder and possibility, but a future that holds both promise and peril. Humanity's reach into space is no longer confined to the realm of science fiction—it is our next great endeavor. Yet, as nations and corporations race to explore and claim their share of the cosmos, we face a critical question: what happens when space becomes a battleground? As technology advances and new players enter the field, the need for a robust legal framework to protect space from militarization and conflict has never been more urgent. Space exploration is at a place where the lines between peaceful exploration and military dominance are becoming dangerously blurred.

A History of Peaceful Intentions: The Outer Space Treaty
The framework for space law, as we know it today, began with the Outer Space Treaty of 1967. In the midst of the Cold War, this treaty established space as a domain for peaceful exploration and cooperation. It prohibited the militarization of celestial bodies, banned the placement of nuclear weapons in space, and declared that space should be free for all nations to explore. The principles set forth were visionary, a recognition that space must be shared by all of humanity. But the world has changed since then. Today, private companies are launching satellites, military

operations in space are expanding, and the challenges of space debris and resource competition loom large. The Outer Space Treaty is no longer enough—it's time to revisit and refine space law for the next phase of human space exploration.

The Rise of Space Militarization
In the decades since the treaty's inception, space has become integral not just to science, but to national security. The very same technologies designed for peaceful purposes are now being adapted for military use. Satellites that once served as instruments of scientific discovery now function as tools of surveillance, communication, and defense. The emergence of military capabilities in space is not just a matter of technological progress; it's an ideological shift that places national security at odds with the principles of peaceful exploration.

We need look no further than the actions of spacefaring nations to understand the stakes. In 2007, China tested an anti-satellite missile that shattered one of its own weather satellites, creating thousands of pieces of debris in orbit. The U.S., Russia, and other nations have since developed similar technologies, all under the guise of defense. But what happens when a space-based missile defense system is deployed? Or when a military satellite is mistaken for a civilian asset? The

risk of conflict is escalating, and the consequences are dire. As militarization increases, the potential for space to become a contested and hostile environment grows ever greater. The peaceful use of space, as envisioned in the Outer Space Treaty, is slipping through our fingers.

The Legal Grey Zone: Defining Military and Civilian Space
One of the core challenges in space law is the lack of clarity between military and civilian uses of space assets. Today, many technologies serve dual purposes—what was once a communications satellite now has military applications, and research satellites double as surveillance tools. This blurring of lines raises critical questions: If a dual-use satellite is attacked during an armed conflict, how do we determine whether it's a legitimate military target? If a nation destroys a satellite, is it an act of defense or an act of war?

The absence of clear distinctions leaves civilian infrastructure vulnerable in times of conflict. Satellites that provide critical services—like disaster relief communication or global weather forecasting—are at risk of being caught in the crossfire. Without clear legal protections, the peaceful uses of space are not just under threat, they are at the mercy of military priorities. International humanitarian law (IHL) holds that attacks during wartime must be proportional and

discriminate, targeting only military objectives. But when it comes to space, those principles are difficult to apply without a clear understanding of what constitutes a military target.

To protect space as a peaceful domain, we need a legal framework that distinguishes between military and civilian space assets. This framework must include protections for satellites used for humanitarian purposes, ensuring they are shielded from attacks and that space remains a zone of safety, not a battleground.

The Growing Threat of Space Debris
As if the threat of conflict wasn't enough, the issue of space debris looms large. Every satellite launched carries with it the potential to contribute to an expanding field of debris that, over time, could render critical orbits uninhabitable. A single piece of debris, traveling at speeds of over 17,000 miles per hour, could destroy a satellite or even a spacecraft. As militarization in space increases, so too does the risk of debris—whether from testing military technologies or from failed satellites. The 2009 collision between a defunct Russian satellite and an operational communications satellite highlighted just how fragile our orbital infrastructure is.

The Kessler Syndrome, a phenomenon where debris collides and creates more debris in a cascading effect, threatens to make space increasingly hazardous for everyone. The growing presence of military activities in space only exacerbates this problem. There is no coherent international agreement on debris removal, nor a standardized system for avoiding collisions. This lack of regulation jeopardizes not only the safety of military assets but also the safety of civilian and scientific satellites.

Space law must address this issue head-on. Nations need to adopt clear standards for debris mitigation, including better satellite design, deorbiting protocols, and guidelines for testing space technologies. If we fail to act, the consequences for future space exploration could be catastrophic.

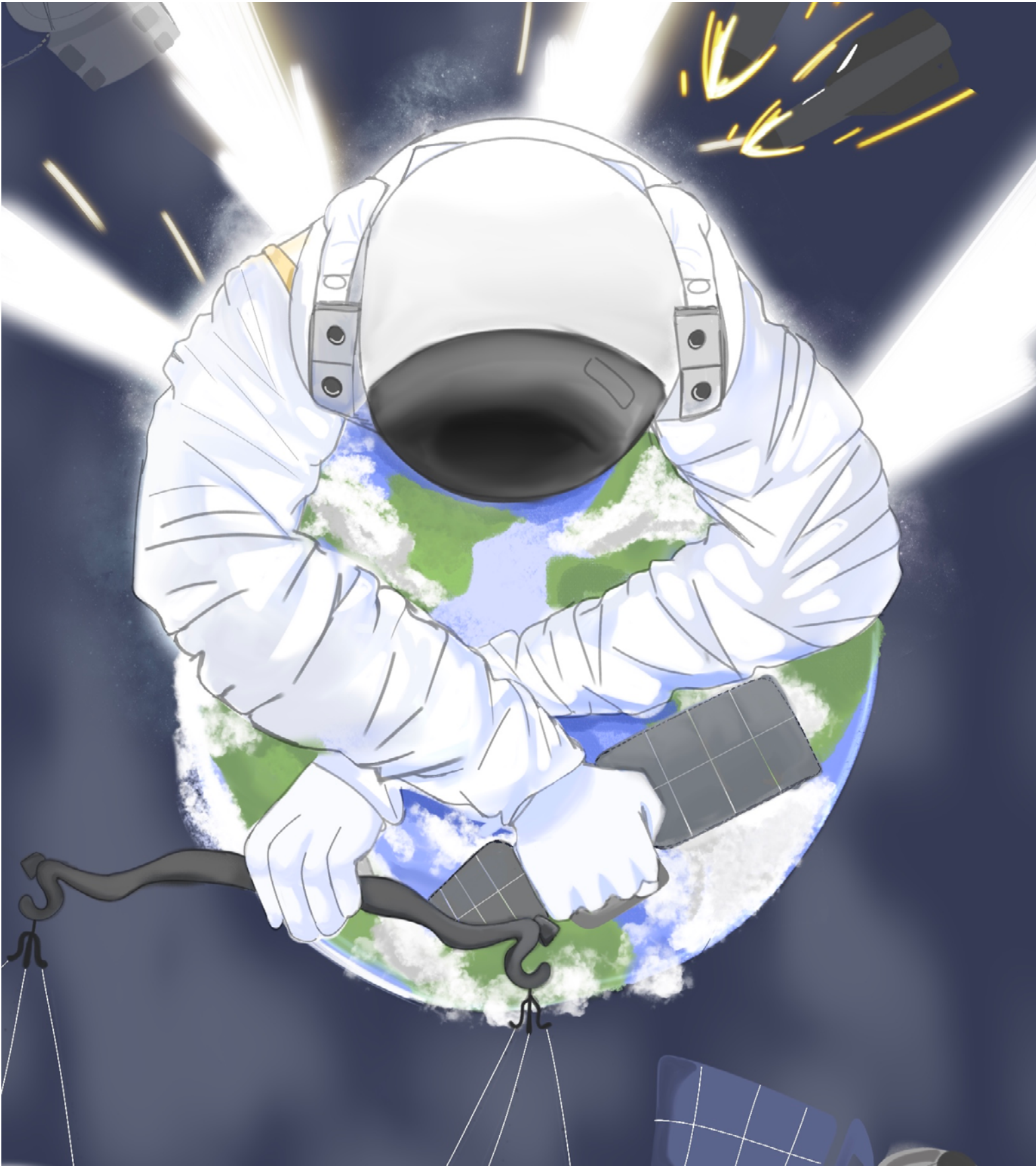
The Need for New Space Law
The militarization of space is not just a challenge for one nation, but a global issue that requires international cooperation and legal innovation. The Outer Space Treaty laid the groundwork, but it is no longer sufficient in addressing the complexities of modern space activities. To ensure that space remains a resource for all humanity, we need a new set of laws that address the current and future realities of space exploration. This should include:

- 1. Clear Definitions of Military and Civilian Space:** Establishing firm guidelines to distinguish military from civilian assets, ensuring protections for critical infrastructure, and reducing the risk of accidental conflict.
- 2. Space Debris Management:** International agreements on debris removal, collision avoidance, and satellite end-of-life management to preserve the orbital environment.
- 3. Ban on Space-Based Weapons:** A clear prohibition on space-based weapons systems that can target satellites or other space assets, to ensure that space remains a zone of peace.
- 4. Regulation of Private Actors:** As private companies increasingly enter space, it is crucial that they are held to the same standards as nation-states, ensuring they operate in ways that prioritize the collective good over national or corporate interests.

Looking to the Future: A Balanced Approach
As we step into this new era of space exploration, we must recognize the delicate balance between progress and preservation. Space holds incredible promise, but its militarization must be carefully managed to avoid turning it into another front of global conflict. Our legal frameworks must not only encourage innovation but also safeguard space for peaceful use, ensuring that future generations can continue to explore, discover, and thrive beyond Earth.

The challenges are enormous, but so is the opportunity. Space is a shared resource—a treasure trove of potential for scientific discovery, human development, and global cooperation. It is up to us, today, to protect it for those who will come after us. The legal battles we fight now will determine whether space remains a final frontier for peaceful exploration, or whether it becomes a realm of constant military confrontation.

Conclusion: Protecting Space for Future Generations
The militarization of space presents both a danger and a challenge—a challenge we must meet with clear, innovative legal action. As the world's space capabilities expand, the need for a cohesive, forward-thinking legal framework grows more urgent. Space must remain a shared resource, available for peaceful exploration and the betterment of humanity. The laws we create today will determine the legacy we leave for future explorers. The question is: will we choose to protect the peace, or will we allow space to become another battleground? ■



FIRST PLACE | ART

Humanitarian Law In Humanity’s Hands

Keira Zhong
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Temple City, California

The piece displays the earth in outer space, with an astronaut protecting the planet from galaxy warfare. The astronaut holds a scale to represent the law while shielding the earth as if incorporating the law as protection against dangerous forces. Additionally, the astronaut holds an artificial satellite on the other hand to convey that technology in space should go hand in hand with the law. This piece shows armed conflict in the galaxy while representing the astronaut as a human shield against the armed danger of space technology and demonstrating how artificial spacecrafts should be used in the name of humanitarian law. ■



RUNNER UP | ESSAY

From Orbit to Battlefield: The Role of IHL in Space

Diya Reddy
Odessa High School, Odessa, Texas

When we look to the stars, we must ask: how do we avoid turning space into the next battlefield? As we continue to explore outer space, conflict may arise in international law and military strategy. While space law ensures that space is peaceful and cooperative, it becomes more militarized as technology advances. International Humanitarian Law (IHL) governs armed conflict and aims to protect both military and civilian lives. IHL is crucial to ensure that any conflict in space is regulated so there is minimal harm. This essay will examine how space law and IHL can work together to maintain peace in space.

Legal Framework and Weaponization of Space

Space law is founded on treaties like the Outer Space Treaty, which establishes the legal framework for space exploration. The treaty bans nuclear weapons in space and restricts military activities to peaceful purposes. Other agreements, like the Rescue Agreement and the Liability Convention, focus on cooperation, astronaut safety, and the registration of space objects.

However, as technology evolves, the difference between civilian and military use of space is becoming blurred. This can be seen through the dual-use satellites that serve communication and military surveillance purposes. Satellites, once mainly for research and communication, are now used for military operations, raising concerns about the weaponization of space.

International Humanitarian Law

International Humanitarian Law (IHL) is a set of rules that aim to make armed conflict less harmful and to limit the ways war can be fought. Its goals are to protect people who aren’t fighting, reduce unnecessary suffering, and control the weapons and tactics used in war. These principles are important to uphold in space as well

as military action could affect Earth and its infrastructure. As Scott Kelly, a former NASA astronaut, says, “Space exploration is a unifying mission for humanity. It’s a mission that requires collaboration, not conflict”. This emphasizes the need for cooperation in space rather than the escalation of militarized conflict.

IHL has two main parts: the Hague Conventions, which govern how wars are fought, and the Geneva Conventions, which protect people during conflicts. These conventions are relevant to space warfare as they provide a framework for limiting the means of warfare, which is crucial in modern space. While these laws were originally designed for conflicts on Earth, there’s growing reason to apply them to space as the militarization of space continues.

Consequences of Armed Conflict in Space

Armed conflict in space could endanger important infrastructure, like communication and weather satellites, which we rely on every day. This could disrupt global communication networks and weather forecasting, affecting daily life and international operations. IHL protects civilians and their property, but it’s complicated when civilian satellites also serve military purposes. Not to mention, destroying a satellite could create space debris, which could harm other satellites. According to IHL, the harm caused by an attack shouldn’t be greater than the military advantage. If space debris disrupts services like communication, it could violate this rule as communication is essential to daily life.

Space debris poses a serious problem in the event of a conflict in space. It can remain in orbit for years, threatening current and future satellite operations and slowing space exploration efforts. IHL states

that the damage caused by an attack should be limited; however, space debris could render parts of space unusable, potentially violating this rule.

What can IHL do?

International Humanitarian Law (IHL) faces several challenges when it comes to regulating space warfare. While existing space treaties focus on keeping space peaceful, they do not address how armed conflict should be handled in space. There is no legal framework to prevent the weaponization of space. One might suggest creating new treaties or protocols to better govern the use of force in space, ensuring that these laws account for the global nature of space activities and the unique risks space warfare poses to environments that all nations depend on.

In conclusion, the need for updated legal frameworks grows as space becomes more militarized. Space conflict poses challenges for space law and IHL, especially in protecting civilian infrastructure, and preventing space debris. To minimize the impacts of space warfare, IHL must evolve. This requires international cooperation and the creation of space-specific laws to ensure that IHL’s core principles such as distinction, proportionality, and necessity, are upheld as we move into this new frontier. Only by working together can we protect both space exploration and humanity from the harmful effects of conflict in space. ■



RUNNER UP: ART

Adrift in Consequence

Teresa Zhao
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Walnut, California

My art piece, titled “Adrift in Consequence”, represents the degeneration of the solar system’s beauty and symmetry in the wake of artificial waste. Human society is long used to being surrounded by their own pollution, so I choose to depict our environment on a cosmic scale to highlight the unnaturalness of the world we live in. Surrounded by an orbiting ring of contamination, the Earth depicted is one that lacks space laws for regulating debris, plastic, and other forms of garbage. How long will it take for Earth’s contamination to spread to other planets? The wilting flowers in the astronaut’s hands is the symbolization of the fragile relationship between humanity and nature, alien to the cold environment of the spaceship much like the pollution alien to the solar system. The contrast between the astronaut’s seclusion and the vast, desecrated space illustrates the consequences of negligence towards space laws and regulation. ■



HONORABLE MENTION | ESSAY

Navigating the Final Frontier: The Role of International Humanitarian Law in Space Armed Conflict

Tejus Sai Suhas Golakoti

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From a realm of dreams and scientific investigation, outer space has gradually become a budding theater for potential military conflict. As more nations and private subjects reach out beyond Earth, the implications for International Humanitarian Law are radical. IHL, which prescribes the conduct of armed conflict, should develop and adjust to this type of warfare, with special features of protection for civilians, preservation of celestial bodies, and mitigating environmental damage. The present essay reviews how IHL applies to armed conflict in outer space, pinpoints omissions in the existing legal framework, and advances proposals so as to make certain that humanity's joint effort to venture into space continues being regulated according to principles of peace and protection.

IHL is thus evolved through conventions such as those of Geneva and purports to restrict the amount of suffering due to an armed conflict. Primarily terrestrial in essence, the concept has stretched applications in space via existent legal

bodies of laws like the 1967 Outer Space Treaty. Under this treaty, nuclear weapons cannot be allowed to be put in space, nor are the celestial bodies to be utilized for anything but peaceful purposes. Yet the treaty has fallen short in developing specific rules relevant to space hostilities.

Principles that are fundamental to IHL include distinction, proportionality, and necessity. These would respectively involve distinguishing between objects that are military and those that are civilian, military actions being no more than proportional to their goals, and any operations that are not essential to a proper military objective; laying them off. It would prove far more tricky in space as satellites and other space technologies have dual functions serving both civilians and the military.

Satellites are a huge part of civilian life and offer services that include navigation, communication, and weather forecasting, among others. Loss of satellites in conflict would render such services unavailable and may have devastating impacts on civilian populations. For example, the space debris generated from the satellite destruction may pose a risk to all objects orbiting around space, therefore creating a big chain reaction—the Kessler Syndrome. This therefore denotes that IHL should consider regulating activities that would have indirect effects on civilian infrastructure.

Outer space does not provide immunity from environmental damage. The

space debris caused by a conflict may still be in orbit many decades later to pose a long-term hazard to any civilian and/or military activity; further, any employment of weapons on celestial bodies risks surface damage with potentially widespread interference with scientific research. Protection of the space environment will contribute to fundamental principles of IHL, including humanity and prohibition of unnecessary destruction.

While IHL is applicable to space, a number of gaps exist in the current legal framework:

Lack of Specificity: The existing treaties do not say anything on the use of force in space or protection of dual-use objects.

Insufficient Regulation of Private Actors: The rise of private companies involved in space exploration calls for an accountability mechanism for compliance with IHL.

Lack of Environmental Safeguards: The existing treaties do not take up the issue of environmental impact arising from armed conflict in space.

In the light of these gaps, the international community should be considering the following measures in an effort to bridge them:

A New Treaty: Clearly needed is a new treaty on the conduct of armed conflict in space, one that provides specific protection both for dual-use objects and for the environment.

Increasing Accountability: Mechanisms for holding private and state actors accountable for violations of IHL in space should be developed.

Encouraging International Cooperation: The possibility of conflict can be reduced by solidifying cooperation between nations in respecting the principles of IHL in their activities in space.

Incorporating Environmental Protections: The elaboration of IHL on space environment preservation will avoid long-term damages.

As mankind further reaches out into space, the principles of International Humanitarian Law must guide our actions to make sure that space remains a domain of peace and cooperation. The unique challenges arising from space conflicts let us guarantee the protection of civilians, maintenance of the environment, and limitation of war's burdens. It is in the pursuit of these ideals that the future of space exploration rests, so that the final frontier shall be subject to laws which are the best of what humanity can achieve. ■



HONORABLE MENTION | ART

Creating a Safe Space

Alina Carney

Kaiserslautern High School, Kaiserslautern, Germany

This piece, titled Creating a Safe Space, encompasses the role of International Humanitarian Law in the shaping of our interstellar environment. With the launch of Sputnik I in 1957, humanity began to fervently explore the cosmos, sparking a twenty year period of rapid and competitive celestial development known as the Space Race. As a result, what once was a vessel for distant dreams has become the cornerstone of the modern world, with extraterrestrial infrastructure, such as the satellite seen in my piece, serving both

civilian and militaristic purposes. The astronaut in my artwork remains firmly connected to Earth as he cultivates the space surrounding him, representing International Humanitarian Law's indispensable work in ensuring that cosmic affairs and development are conducted on the basis of humanity, upholding the regard for civilian protection even as our world expands into the infinite skies above ■



FIRST PLACE | ESSAY

Protecting Critical Health Infrastructure in Space Under International Humanitarian Law

Emaan Amir

James E. Taylor High School, Katy, Texas

In an era where global healthcare increasingly depends on space-based infrastructure, protecting these critical systems has become fundamental to human welfare. From remote surgery guidance in rural areas to real-time epidemic tracking, space-based health systems save countless lives daily. During humanitarian crises and conflicts, these systems become even more crucial - enabling emergency response coordination, telemedicine in conflict zones, and the distribution of vital medical supplies to vulnerable populations. The loss or disruption of these space-based health assets could mean the difference between life and death for millions of people worldwide.

Consider the impact during recent natural disasters: satellite communications enabled critical medical response during the 2023 Morocco earthquake, while health-monitoring satellites tracked the spread of infectious diseases across refugee camps in multiple conflict zones. In remote regions, from the Arctic to sub-Saharan Africa, rural communities depend on satellite-based telemedicine for access to specialized healthcare that would otherwise be unavailable. These examples underscore why protecting space-based health infrastructure is not merely a technical legal challenge, but a humanitarian imperative.

The intersection of space law and International Humanitarian Law creates unique challenges in protecting space-

based health infrastructure. While Article 48 of Additional Protocol I to the Geneva Conventions establishes the principle of distinction between civilian and military objectives, its application to dual-use satellites supporting healthcare systems remains legally ambiguous (Dinstein, 2023). This analysis examines how existing IHL frameworks must evolve to address the protection of space-based health assets, particularly in light of emerging technologies and increasing militarization of space.

Legal Framework and Current Gaps

The existing legal regime governing space-based health infrastructure comprises several interconnected frameworks. The Outer Space Treaty (1967) establishes the foundational principles of space law but lacks specific provisions for protecting health-critical infrastructure. Article IX's consultation requirements prove insufficient for rapid-response scenarios involving threats to medical satellites. The Geneva Conventions and Additional Protocols establish protections for medical units but predate the integration of space-based assets into healthcare delivery.

The ICRC's 2023 position paper acknowledges this gap, particularly regarding the classification of dual-use satellites supporting both civilian healthcare and military communications (International Committee of the Red Cross, 2023). This challenge is further

complicated by the emergence of commercial space actors providing critical health infrastructure services, as highlighted in Lyall and Larsen's comprehensive analysis of space law evolution (Lyall & Larsen, 2020).

The UN COPUOS Guidelines on Long-term Sustainability of Outer Space Activities (2019) address debris mitigation but fail to specifically protect health-critical space infrastructure. This oversight becomes particularly concerning when considered alongside the increasing deployment of mega-constellations, as analyzed by Jakhu and Pelton in their work on global space governance (Jakhu & Pelton, 2017).

Technical Vulnerabilities and Legal Implications

Current space-based health infrastructure faces several critical threat vectors that challenge existing IHL frameworks. Kinetic threats through direct-ascent anti-satellite weapons and co-orbital interference capabilities pose immediate risks to health-critical satellites. Recent analysis by the Secure World Foundation (2022) documents seventeen known anti-satellite weapons tests between 2007 and 2022, highlighting the growing threat landscape. Electronic warfare, including jamming and spoofing of satellite signals, can disrupt critical healthcare communications. The Union of Concerned Scientists (2021) has documented over three hundred

instances of satellite signal interference affecting healthcare operations between 2018 and 2021. Additionally, cyber threats pose an increasingly significant risk; as documented in Schmitt's Tallinn Manual 3.0 (2023), the increasing digitalization of space assets creates new vulnerabilities in health infrastructure systems.

Recent technical analysis demonstrates that 76% of health-critical satellite systems utilize shared infrastructure that defies traditional IHL classification as purely civilian objects (von der Dunk, 2023). This technical reality necessitates legal evolution, particularly in light of the findings presented in the Space Security Index 2022 (Project Ploughshares, 2022).

Application of IHL Principles to Space-Based Health Assets

The principle of proportionality under Article 51(5)(b) of Additional Protocol I necessitates special consideration in the space domain due to the unique challenges posed by orbital mechanics and the creation of space debris, which can result in persistent hazards to health-critical civilian infrastructure. This consideration becomes particularly relevant given the findings of Boothby's analysis of weapons law (Boothby, 2016) regarding the long-term effects of space weapons.

Enhanced Protection Framework

To address these challenges, the proposed legal framework modifications must be comprehensive

and interconnected. The establishment of an enhanced protection status for "protected space infrastructure" under IHL builds on precedents analyzed in Crawford's work on identifying protected objects in modern warfare (Crawford, 2020). Implementation of verification protocols draws from the successful models described in Tronchetti's handbook on space law (Tronchetti, 2019). The development of expedited arbitration procedures based on existing space law dispute resolution frameworks, as outlined by von der Dunk and Tronchetti (2015), provides essential rapid response capabilities.

Technical Solutions Supporting Legal Compliance

Implementation requires several integrated technical solutions. The development of standardized transponder systems for protected assets builds on recommendations from the International Telecommunication Union's Radio Regulations Board (2022). Integration of active debris removal capabilities follows guidelines established in the Inter-Agency Space Debris Coordination Committee's technical report (IADC, 2021). Implementation of backup communications pathways, as recommended by the World Health Organization's Global Strategy on Digital Health (WHO, 2023), ensures continuity of critical health services.

Enforcement and Verification

The effectiveness of these protections requires robust enforcement

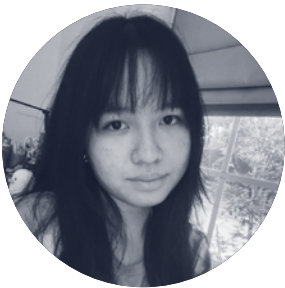
mechanisms working in concert. The establishment of an international space situational awareness network, as proposed by the European Space Agency's Space Safety Program (2021), provides essential monitoring capabilities. Development of specific sanctions regimes for violations builds on frameworks analyzed in Blount's work on space law enforcement (Blount, 2019). Implementation of transparent verification systems follows models presented in the Center for Strategic and International Studies' Space Threat Assessment (Harrison et al., 2021).

Conclusion

The protection of space-based health infrastructure requires a synthesis of technical capabilities and legal frameworks. Current IHL principles must evolve to address the unique characteristics of orbital operations while maintaining their fundamental humanitarian objectives. The proposed modifications to existing legal frameworks, supported by specific technical implementations, provide a pathway to ensuring the continued operation of critical health infrastructure in an increasingly militarized space environment.

More than just a legal framework, these protections represent our commitment to preserving humanity's ability to deliver healthcare in an increasingly complex world. As space becomes more contested, protecting health infrastructure isn't just about maintaining satellites - it's about ensuring that a child in a remote village can still receive specialist care, that disaster response teams can coordinate effectively during crises, and that global health systems remain resilient in the face of conflict. The success or failure of these protective measures will have direct implications for millions of lives on Earth, making their implementation not just legally necessary, but morally imperative. ■

“The success or failure of these protective measures will have direct implications for millions of lives on Earth, making their implementation not just legally necessary, but morally imperative.”



FIRST PLACE: ART

Shooting Stars or Shrapnel?

Sarah Nguyen
Harmony School of Advancement, Houston, Texas

This artwork depicts a reality without governing space laws ensuring safety. Here, we see an astronaut in space as bombs scatter around, shining harshly in the helmet’s reflection. Their hand is outstretched in a vain attempt to shield themselves. This isn’t the first time this has happened, as we can see space debris, broken satellites, and damage in the suit as blood seeps through its cracks.

On their arm, a flag is shown, representing how the astronaut can be interpreted as a military target. But on top of that lies a white, bloodied, and tattered piece of cloth, showing their humanity and desire for peace above all else. A place that symbolized boundless curiosity and exploration has been turned into a warzone, and where you could once expect to see shooting stars lie shrapnel.

Through this piece, I hope to portray the critical need to uphold IHL, even in space. ■

RUNNER UP: ESSAY

Space Law and Armed Conflict: How to Protect Celestial Bodies

Sahana Sivam
North Allegheny Senior High School, Pittsburgh, Pennsylvania

I. The Endangerment of Celestial Bodies

In the ominous quietude of outer space, satellites dutifully orbit Earth. They grant us information about the planet’s climate and weather, allow for global communication, track disease and famine, even helping emergency workers respond to natural disasters (“What Is a Satellite,” 2014) — all concepts we often take for granted and reap the benefits of without second thought. But behind this peaceful routine lurks the threat of an invisible, calculating assassin — a missile fired from Earth—targeting satellites in a moment of conflict. A satellite’s destruction might not be immediate to civilians below, but the chaos of the aftermath — a cascade of global panic due to a broken communication network, loss of GPS, and delayed emergency services just to name a few — would be felt by nearly every person on Earth (Dvorsky, 2015). Man-made satellites aren’t the only entities to be endangered by armed conflict, however.

Our very own natural satellite was once at risk of the repercussions of the militarily ambitious 1960’s Space Race between the Soviet Union and the United States (Richelson, 2014). Specifically, the United States’ Project A119 — a plan to detonate a hydrogen nuclear bomb on the Moon — was devised as a demonstration of power to intimidate the Soviet Union and gain an advantage in the escalating arms race (Piesing, 2023). While this project was never carried out, its mere conception reveals how celestial bodies could be drawn into geopolitical conflicts, blurring the line between “Earthly” tensions and outer space. Today, as nations develop advanced space technologies and anti-satellite weapons, questions of legal protections for space assets become increasingly imperative. What laws exist to safeguard citizens and celestial bodies like the Moon and satellites? How does

“As nations develop advanced space technologies and anti-satellite weapons, questions of legal protections for space assets become increasingly imperative”

International Humanitarian Law apply beyond Earth's atmosphere? And critically, what are the implications of gaps in these protections?

II. Current Protections

The International Humanitarian Law (IHL) is a set of rules seeking to limit the effects of armed conflict (International Humanitarian Law, n.d.). Its range covers the protection of individuals and groups who do not take part in fighting and establishes limits on the means and methods of warfare (What is International Humanitarian Law, 2007). Under the IHL, the principle of proportionality, for one, also helps assets in space like satellites from armed conflict. Proportionality is outlined in Article 51(5)(b) of Additional Protocol I to the Geneva Conventions, stating that parties to a conflict must refrain from launching attacks that could cause incidental harm to civilians, civilian objects, and space-based assets where the harm would be excessive in relation to the military advantage gained (Berrang, 2023). Proportionality essentially measures the magnitude of the perceived benefit of armed conflict in comparison to the potential repercussions on society and celestial bodies, encouraging more calculated decisions and limiting harm. For example, a satellite providing GPS and internet to government and civilian sectors is a critical infrastructure. An attack on such a satellite, while it might provide some sort of military advantage, could have devastating consequences for civilians on Earth, such as causing plane crashes and traffic accidents (International Expert, 2018). The principle of proportionality also applies to space debris, which is a major concern in armed conflict. Attacks using anti-satellite weapons can induce long-lasting debris with unpredictable movement that threaten satellites due to the increased risk of future satellite-debris collisions (Berrang, 2023). IHL protects against such actions by requiring that any

attack on space objects be carefully assessed to minimize excessive harm to civilians and prevent long-term damage to space assets.

With the Moon and other celestial bodies too in mind, after the introduction and rebuttal of Project A119 in 1958, treaties were established protecting them from future militarization. This includes the highly successful Outer Space Treaty of 1967, consisting of 17 articles that govern how countries should conduct their activities in space. This treaty, for one, prohibits nuclear weapons or other weapons of mass destruction in orbit or on celestial bodies or station them in outer space in any other manner (Article IV), not only disputing the attempt of Project A119, but also effectively eliminating possibilities of armed conflict in space ("The Outer Space Treaty," n.d.). As of June 2024, 115 countries across the globe have ratified this treaty, enforcing it in mostly universal practice ("The Outer Space Treaty at a Glance," n.d.). The following Moon Agreement in 1979 served as a reiteration of the Outer Space Treaty with minor additions, most notably the reinforcing of the ban of military activity in space and also that the Moon and its natural resources are the common heritage of mankind—the ethical concept that it belongs to all of humanity instead of use to a sole few powerful countries ("Moon Agreement," n.d.; Taylor, n.d.). However, only a few countries have ratified this sequel treaty due to its more restrictive measures.

III. Sustained Implications

Despite being the foundation of space law, the Outer Space Treaty still lacks a centralized body or international organization tasked with monitoring compliance and enforcing its provisions, making it challenging to hold nations accountable for violations (Ligor, 2022). The treaty also does not provide clear consequences for weaponizing space or attacking space assets, which

can undermine its effectiveness and authority in preventing conflicts in space (Islam, 2020). In addition, as new technologies like ASAT missiles, space-based lasers, and cyberattacks on satellites evolve, existing protections fail to address these modern threats other than nuclear weapons (Blatt, 2020). Overall, the risk of advanced military technology in space remains largely unregulated. Addressing these vulnerabilities is crucial to ensuring space remains a secure domain for both military and civilian use.

Additionally, while the Outer Space Treaty prohibits certain military activities on the Moon, eg. establishing bases and weapon testing, it does not specifically define what constitutes "militarization" nor does it provide a clear framework for addressing the growing interest in lunar resources. Article IV of the treaty states that "the Moon and other celestial bodies shall be used by all States Parties exclusively for peaceful purposes," however, the "peaceful purposes" are never explicitly defined, leading to ambiguity. Some nations interpret it as banning all military-related activities, while others argue that non-aggressive military operations are permissible. But as countries continue to explore the Moon for water, minerals, and other valuable assets (space resource utilization), the absence of clear regulations regarding the protection of the Moon creates significant gaps in knowledge of what nations can and cannot do. This lack of clarity leaves the Moon vulnerable to potential territorial disputes and competition over resources, which could escalate into conflicts, especially if nations or private companies vie for control over similar lunar regions and resources. Such disputes also are a reason why many nations still have yet to sign the Moon Agreement of 1979 (only 18 countries to this day have ratified it)—many saw it as a limitation of capitalizing on the economic potential of the Moon (Tronchetti, 2010). This lack of agreement is a

major concern, as it opens the door to potential conflicts over territorial claims and resource exploitation of our natural satellite.

IV. The Future of Space Law and Humanity

To address the gaps in current space law, it is imperative that nations work collaboratively in creating binding and enforceable international agreements that specifically regulate armed warfare and the protection of space assets. Proposals for arms control in space could perhaps draw on already established frameworks for weapons control on Earth such as nuclear disarmament treaties, in the end ensuring that space remains a peaceful domain for exploration and not a place of conflict and harmful competition. There is also a need to update and or create new treaties addressing challenges posed by modern space warfare like anti-satellite weapons, because those existing, like the Outer Space Treaty, may not adequately regulate modern threats to space security. These treaties must also address the ethical considerations of resource utilization in space, particularly on the Moon. Strengthening these agreements would be pivotal in preventing the weaponization of space and ensuring that all nations share responsibility for maintaining it, because as humanity's footprint in space expands, nations must acknowledge their ethical responsibility to preserve space for all.

The protection of space and its entities is not just an abstract notion but a pressing reality and universal responsibility. The visualization of satellites peacefully orbiting, unknowingly in peril, symbolizes not only the vulnerability of our space assets but the fragility of the systems that are supposed to protect these celestial bodies from harm. Just as the Earth's environment requires protection from destructive practices, so too does space. Without concrete, enforceable laws to prevent its weaponization, we risk turning it into a contested, militarized domain with endless repercussions. The decisions we make now will shape whether space remains a realm of discovery and cooperation or becomes another battleground—one we destroy as fast as we explore. ■



RUNNER UP: ART

Gaze of Desolation

Samriddhi Basak
Orlando Science High School, Orlando, Florida

This artwork explores Space Law and the impact of armed conflict in outer space, focusing on forced awareness and the erosion of humanity through the interplay of power and vulnerability. Humanity's helplessness is symbolized by fingers forcing an eye open, compelling it to witness the devastation of militarization and conflict. Within the eye, a shattered Earth reflects the planet's fragility and the destruction caused by unchecked power. Debris floating off the Earth and beyond the frame

represents the loss of identity and culture, while adding an abstract element that evokes the absence of gravity in space. Tears streaming from the eye express grief, powerlessness, and the gradual loss of humanity. The bold contrast between pink and green/blue conveys the tension between innocence and the dominating forces of authority. These visual elements highlight the devastating consequences of militarized actions in space, emphasizing humanity's vulnerability and the urgent need for regulation. ■



HONORABLE MENTION: ESSAY

Analyzing Legal Protection in the Use of Outer Space and Relating it to Armed Conflict and Space Entities

Arushi Gowda
Central Jersey College Prep Charter School, Somerset, New Jersey

As space technology advances, so do the concerns about the militarization and weaponization of outer space, making it a crucial area for global security, technological progress, and international collaboration. International laws, including treaties like the Outer Space Treaty (OST) of 1967 and the principles of International Humanitarian Law (IHL), create legal frameworks for the peaceful use of outer space. However, there are still significant gaps in these protections, particularly regarding the regulation of armed conflict in space and the safeguarding of celestial bodies, astronauts, and satellites.

Existing Protections Under International Law

One of the key documents governing outer space use is the Outer Space Treaty (OST) of 1967, which lays out essential principles for its utilization. Article IV of the OST prohibits the deployment of nuclear weapons and other weapons of mass destruction in orbit, on celestial bodies, or in outer space. The treaty also stipulates that the moon and other celestial bodies must be used solely for peaceful purposes, explicitly banning military bases, fortifications, or weapons testing (Treaty on Principles Governing the Activities of States in the Exploration and the Use of Outer Space, 1967).

IHL, which governs conduct during armed conflicts, is also applicable to activities in outer space. It forbids indiscriminate attacks that could harm

civilians and non-military objects. The Geneva Conventions, a core part of IHL, require combatants to differentiate between military and civilian objects. In theory, this principle should extend to satellites and space infrastructure that provide vital civilian services like communications, navigation, and weather monitoring.

Gaps in Protection for Armed Conflict in Space

While existing treaties like the OST lay a foundation for space law, they do not adequately address contemporary military advancements such as anti-satellite weapons and cyberattacks on space infrastructure. The treaty also does not explicitly prohibit conventional weapons in space, nor does it prohibit the use of force against space assets, including planets and stars, is prohibited. However, in recent years, nations like the United States, Russia, China, and India have conducted tests of anti-satellite (ASAT) weapons, which raises concerns about the unclear legal framework governing the use of force in outer space.

For instance, India’s 2019 ASAT test, dubbed “Mission Shakti,” resulted in the destruction of a decommissioned satellite, creating debris that endangered other space assets. The absence of international laws to regulate such actions highlights the shortcomings of current treaties. Moreover, the Outer Space Treaty (OST) lacks enforcement mechanisms; it does not define

consequences for violations or provide procedures for resolving disputes in the event of armed conflict.

Another significant issue is the lack of regulations surrounding cyber warfare in space. Cyberattacks targeting satellites and space-based infrastructure from Earth-based organizations present a serious security threat. Unfortunately, existing treaties offer minimal coverage on this matter. Given that modern militaries heavily depend on satellite technology for reconnaissance, communication, and missile guidance, the lack of clear cyber protections is a notable deficiency.

Protections for Celestial Bodies

The Moon Agreement of 1979, a follow-up to the OST, attempts to regulate the use of celestial bodies by declaring that their resources are the “common heritage of mankind.” This principle suggests that no nation can claim sovereignty over the moon or other celestial bodies. However, this treaty has been ratified by only a handful of countries, limiting its effectiveness in enforcing legal protections.

Despite the Moon Agreement’s intended goals, the legal status of lunar resource exploitation remains uncertain. The recent surge of interest in moon mining—specifically by private companies like SpaceX and Blue Origin—has sparked debates over ownership rights and environmental safeguards. The U.S. Artemis Accords (2020) offer a framework for utilizing

space resources, yet they fall short of creating binding international law, raising concerns about possible disputes over lunar resources.

Protections for Astronauts

Astronauts are afforded special legal protections under the Rescue Agreement of 1986, which mandates that states assist astronauts in distress and ensure their safe return to their home country. This agreement emphasizes that astronauts should be viewed as “envoys of humankind.” Furthermore, Article V of the OST advocates for mutual assistance among nations in cases of accidents or emergencies involving astronauts.

However, these protections do not specifically address situations involving armed conflict. If a space station or spacecraft were attacked during a war, there is no definitive legal provision ensuring the safety of astronauts beyond the general principles of International Humanitarian Law (IHL). This uncertainty highlights the urgent need for more robust legal frameworks to safeguard human life in outer space.

Protections for Satellites

Satellites are essential for global communications, navigation, and security, yet they receive limited legal protections under current international law. The Registration Convention of 1976 requires that all launched space objects be registered with the United Nations, promoting accountability.

Meanwhile, the Liability Convention of 1972 holds launching states responsible for damages caused by their space objects, including those resulting from collisions or malfunctions.

Despite these regulations, the intentional targeting of satellites is still a contentious issue. There is no clear prohibition against attacking satellites during armed conflict, which creates a legal gap that could be taken advantage of by both state and non-state actors. As military operations increasingly depend on satellite technology, this concern becomes more pressing, as conflicts could potentially extend into space, leading to catastrophic outcomes.

The Role of International Humanitarian Law in Regulating Space Warfare

International Humanitarian Law, which regulates conduct during warfare, does apply to space conflicts, but it lacks specific provisions that address the unique characteristics of outer space, which differ significantly from those on Earth. The core principles of IHL—distinction, proportionality, and necessity—should theoretically apply to conflicts in space. However, the absence of legal precedents complicates enforcement.

One proposed solution is to create a new international treaty that specifically addresses space warfare and military conduct in outer space. The Woomera Manual on the International Law of

Military Space Operations, which is currently being drafted by legal experts, aims to establish a legal framework for conflicts in space. This manual seeks to clarify how international humanitarian law applies to space operations and to set guidelines for the responsible use of space during armed conflicts.

Conclusion

While existing international treaties like the Outer Space Treaty, the Moon Agreement, and the Liability Convention lay the groundwork for space law, they do not adequately tackle the modern challenges associated with armed conflict and the protection of celestial bodies, astronauts, and satellites. The rapid development of space technology, along with the growing militarization of space, highlights the urgent need for updated international legal frameworks through new agreements to address these risks.

Ultimately, as humanity’s activities continue to extend beyond Earth, ensuring the legal protection of space assets and human life must be a top priority. By strengthening legal frameworks and improving enforcement mechanisms, the international community can work to prevent outer space from becoming a battleground and maintain its status as a realm dedicated to scientific advancement and global cooperation. ■



HONORABLE MENTION | ART

Mom, Look

Abigail Welsh
Paul R. Wharton High School, Tampa, Florida

The piece, “Mom, Look,” highlights the devastation caused when space law is disregarded. This artwork tells the story of a stargazing mother and child the night of a kinetic attack on a satellite. The resulting fallout of space debris can be attributed to a lack of due regard and proportionality assessment. The child wearing an astronaut’s helmet is starstruck and oblivious, indicating the innocent lives effected while simultaneously representing the naivety

of the decision made that ignored its broader impacts. The mother cast in shadow is forced to grapple with the situation at hand, ignoring her child’s calls, and confronting the culprit and audience with her tearful gaze as they are forced to flee. However, it is not only two civilians affected by the scene unfolding. The destruction of the moon in the direct line of the crosshair showcases the broader global impact of the decision made. ■



FIRST PLACE | ESSAY

A Theoretical Analysis of Weapons Usage and Their Implications in Outer Space Armed Conflict

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Florida State University, Tallahassee, Florida

As the age of space exploration takes off at an unprecedented rate, with new discoveries, satellite technologies, missions, and spacewalks, the world has seen an increase in global cooperation and media attention orbiting the interstellar. However, this foray into the final frontier may have unintended consequences. Increased space presence from all states has led to tensions sparking even for events such as a satellite from one state nearing the orbit of another, resembling Cold War-era hostility. Taking this increasingly relevant political atmosphere into account, we must assess how International Space and Humanitarian Law governs space activities, prepare for the possibility of armed conflict in outer space, and devise methods for further defining terminology and setting precedents for the legality of space activities.

While the Outer Space Treaty (OST) directly prohibits the use of nuclear weapons or other weapons of mass destruction, there is still the possibility of other forms of attack that are both legal and viable in space. Such weapons of potential use include kinetic anti-satellite weapons (ASATs), electromagnetic pulse and radiation weapons, and ‘soft kill’ weapons. Each of these weapons have different mechanisms of operation and consequences that must comply with the principles of International Humanitarian Law (IHL) in order to be feasible for use in armed conflict. This discussion of weapons of choice

in space-related armed conflict shall be limited to the aforementioned long-range attack devices; while there is a prospect for close quarter combat, our current capability for spacecraft design, protections on astronauts, and constraints on military activities in space when they affect protected persons make this a less practical mode of assault.

ASATs are typically missiles that physically collide with satellites, causing satellites to splinter into countless pieces, and scattering minuscule particles of space debris within orbital range. This debris can make damaging impact with satellites, civilian, governmental, and commercial. Furthermore, removing this debris is impractical due to the number of particulates infiltrating the atmosphere, the size of the particulates, and cost, and time. As more and more space debris accumulates, the risk of encountering damaging space debris increases astronomically. The most well-known instance of ASAT firing was a Chinese test in order to destroy a satellite in 2007, leading to millions of space debris particles polluting several orbits, some particles at sizes of up to 10 cm large.⁷ Due to the proliferation of space debris particles across the outer part of Earth’s atmosphere, lack of comprehensive and effective cleaning procedures, and risk of damage to other satellites and celestial bodies, the use of ASATs could be considered as having widespread, long-term, and severe consequences. Thus, under

Article 55 of the Additional Protocols to the Geneva Conventions, ASATs would be prohibited due to their potential for extensive environmental destruction.

The detonation of any kind of nuclear weapon produces gamma rays that cause electromagnetic pulse and radiation, delivering a shock that destroys sensitive circuitry in electronics. However, because the entrance of nuclear weapons in space is prohibited by the OST, there are some workarounds that must be employed to ensure the treaty is not violated and that people on Earth are not affected by the attack. If the nuclear weapon is detonated at a sufficiently high altitude that Earth's surface nor no human would incur any damage, but low enough that the detonation site would fall within the limits of what is defined as "space," electromagnetic pulses and the following radiation would be plausible weapons to apply when attempting to eliminate enemy satellites over a considerable area. However, due to the wide range of EMP attacks, there is a strong chance of accidentally targeting civilian satellites in the attack, disrupting communication, navigation,

weather forecasting, and other services for civilians. Because there is a disproportionate effect on civilians and their entities compared to the military advantage that could have been gained from the attack, EMP attacks would violate the Proportionality principle of IHL.

'Soft kill' weapons are those that work to disable satellite functionality. The previous examples of ASATs and EMPs would fall under the category of hard-kill weapons, in which the targeted object is completely destroyed. Soft kill weapons usually involve jamming satellites or operating systems via cyber-attacks, high-powered microwaves, and high-energy lasers, crippling communications between enemy combatants. However, a major complication for defending against such attacks is that cyber-attacks can be difficult to detect and even harder to predict. And, as technology grows, new ways to coordinate cyber-attacks arise nearly every day, forcing adaptation to be able to create constant safeguards against attack. Because cyber attacks can be carried out by virtually anyone with the requisite knowledge, non-state entities — regardless of

presence in outer space — can also enter conflict situations, creating another complication to defining the agents involved. Another issue is how IHL can apply to cyber attacks. IHL can only pertain to cyber-attacks during armed conflict and there is much debate if cyber-attacks can be considered an act of violence under Article 49 of the Additional Protocols, further raising question to legitimacy defense against soft kill weapons in outer space. Soft kill weapons are more targeted than hard kill weapons, so they can better serve specific military goals and can minimize the general risk to civilian objects. Notwithstanding of the legal black hole of whether cyber-attacks stand in terms of violence and if self-defense can be legally engaged, they are much more usable during armed conflict in outer space because they better satisfy the IHL principles of Proportionality and Military Necessity, while still having a comparatively lower environmental impact than hard kill methods, as in accordance with Article 55 of the Additional Protocols.

To accommodate for the increased rate of space exploration, our rising dependence of space technologies for communication, and the intensified tensions that have arisen from the proximity of state-owned space objects to one another in orbit, we must improve existing definitions and policies regarding the use of weapons and armed conflict in outer space to better reflect new innovation in the space industry and how political climates have evolved to incorporate the field. ASATs, EMPs, and soft kill weapons each have unique ways of targeting and carrying out attack, and we must examine how IHL is able to anticipate and address the aftereffects of these attacks in order to minimize the impacts on civilians and civilian objects while still accomplishing military objectives. ■

“We must assess how International Space and Humanitarian Law governs space activities, prepare for the possibility of armed conflict in outer space, and devise methods for further defining terminology and setting precedents for the legality of space activities.”



FIRST PLACE | ART

International Humanitarian Law In Space

Nathalia Collazo

Sacred Heart University, Bridgeport, Connecticut

Inspired by the theme of "Space Law and Armed Conflict," I used mixed media depicting a satellite orbiting Earth, surrounded by fragments of space debris. Included is a U.S. astronaut placing an American flag on the moon with the Earth's view. The satellite serves dual purposes: one half representing communication and weather forecasting. The other half symbolizes military applications. I used mediums such as pencil for sketching, outlined with black marker, oil pastels, acrylic paint, and colored pencils. For the space

debris, I glued plastic, blue, gold, and white pieces of paper, tin foil, and tissue pieces on the paper. Also, the environmental impact with abstract representations of space pollution and its potential consequences on Earth due to human presence in space are highlighted. The astronaut represents protection in armed conflict. These ideas provide a foundation for investigating the complex relationship between space operations and international law through art. ■



RUNNER UP | ART

**The Silent Witness:
The Cost of
Conflict in Space**

Mahathi Tallapragada
Florida State University,
Tallahassee, Florida

This acrylic painting depicts a lone astronaut gazing solemnly forward, with a cracked helmet depicting a scene of space warfare in its reflection. The cracks stemming from the center of the helmet imply that the astronaut was a victim of the attack depicted in the helmet's reflection. In reference to International Humanitarian Law, this piece offers a reflection of who is protected during armed conflict in space. While astronauts often serve purposes for both civilian and military research in outer space, any such attacks upon space entities or people in space must still follow the principles of IHL. This piece raises questions about the validity of the attack depicted and the possible avenues for preventing future attacks in order to usher in new peace in the Final Frontier. ■



FIRST PLACE | ESSAY

**Becoming a Guardian of
the Galaxy: Charting IHL's
Path in the Final Frontier**

Michael Boulis
Texas A&M College of Medicine, Bryan, Texas

**Introduction: The Need
for Space Law**

Since the inception of international humanitarian law (IHL) from the first Geneva Convention in 1864, it has traditionally developed within the context of terrestrial conflict here on Earth. Over the same time period, territorial boundaries between nations have become more clearly mapped out, yet disputes over these boundaries have grown equally as frequent and intense. With this said, the race to space, which began in 1957 with the launch of Sputnik 1 by the Soviet Union during President Eisenhower's administration, highlights how advancements in space exploration have outpaced the development of IHL (U.S. Department of State, "Sputnik and the Dawn of the Space Age"). The rapid evolution of technology, coupled with a growing reliance on space for military, commercial, and civilian activities, underscores the urgency of developing a legal framework to address the challenges of space as a new frontier for armed conflict (United Nations Office for Outer Space Affairs).

**Current Space Law and
Its Limitations**

The 1967 Outer Space Treaty (OST), the cornerstone of international space law, presents a framework for peaceful exploration and use of outer space, including celestial bodies. However, the OST's provisions are increasingly inadequate to address the evolving threats in space, such as militarization, the development of anti-satellite (ASAT) weapons, and the accumulation

of space debris. While the OST prohibits the placement of nuclear weapons in space and stipulates that space should be used for peaceful purposes, its broad and general language provides little in the way of enforceable regulations. This gap in legal clarity has become increasingly problematic as the technological landscape of space exploration shifts, bringing with it new vulnerabilities and the potential for conflict (International Committee of the Red Cross, "Military Operations in Space: Law and Policy"). Furthermore, the Moon Agreement of 1979 attempted to regulate the use of extraterrestrial resources, but it failed to gain significant support, leaving a legal void in space exploration (United Nations Office for Outer Space Affairs).

**Dual-Use Satellites and
Military Implications**

As human reliance on space-based technologies has grown, the dual-use nature of many satellites further complicates legal protections under IHL. For instance, a civilian weather satellite can easily be repurposed for military reconnaissance, raising concerns about what constitutes a legitimate military target under IHL and when it can be targeted. Such dual-use technologies exacerbate the complexity of applying IHL in space and highlight the difficulty of distinguishing between lawful and unlawful actions during armed conflict (Coll, "Space and International Law"). The development of space combat systems, such as ASAT missiles, is particularly concerning. These weapons, capable of targeting

both civilian and military satellites, further challenge the application of IHL by introducing the risk of indiscriminate destruction in space. In 2007, China conducted an ASAT test by destroying one of its own weather satellites, an act that demonstrated both the vulnerability of space assets and the limitations of current legal protections (International Committee of the Red Cross, “Outer Space: Applicability of IHL in Space”). Such actions illustrate the pressing need for more stringent and enforceable regulations governing the use of force in space (Cheng, “The Militarization of Outer Space”).

The Growing Issue of Space Debris

The emergence of space debris, a byproduct of military and civilian activities in orbit, has added another layer of complexity to the issue of space security. The destruction of satellites, whether due to military conflict or technical failures, results in fragments that orbit Earth at high velocities, posing a threat to both functional satellites and the safety of astronauts. In 2007, China's ASAT test created thousands of pieces of debris, demonstrating how a single act of aggression could have long-term repercussions for space operations (Launius, “Space Debris and the Space Age”). While there are guidelines for mitigating space debris, the legal framework for addressing it remains inadequate. There are currently no binding international laws regulating the removal or prevention of space debris, leaving it up to individual nations and private entities to take responsibility for space junk management (United Nations Office for Outer Space Affairs). The risks posed by space debris are a direct consequence of the lack of comprehensive legal frameworks and underscore the urgent need for international collaboration to address space security issues (DeFranco, “International Space Law and the Issue of Space Debris”).

Cybersecurity and Space Warfare

As military uses of space have increased, so too has the vulnerability of space assets to hostile actions. In addition to ASAT missiles, the development of cyber capabilities aimed at disrupting or hijacking space systems further complicates the security landscape. Satellite jamming and hacking are becoming increasingly common tactics employed by state and non-state actors to disable or take control of satellites. These actions can interfere with both civilian and military operations, ranging from communication networks to GPS systems, and exacerbate the risks posed by the growing militarization of space (Taylor, “Cybersecurity in Space: The Growing Threat of Satellite Interference”). Yet, despite these developments, IHL's applicability to cyber warfare in space remains unclear. The lack of clarity in legal standards governing space-based cyber attacks further highlights the gaps in current regulations and the need for a more robust and comprehensive legal framework (Klint, “Space Warfare: The Cyber Dimension”).

The Role of Private Companies in Space Exploration

As private companies like SpaceX and Blue Origin increasingly participate in space exploration, issues of resource exploitation, environmental degradation, and competition over celestial territories will likely escalate. While the Moon Agreement's provisions on the “common heritage of all mankind” have been largely ineffective, the commercialization of space presents new challenges for resource regulation. Companies are positioning themselves to mine asteroids, exploit lunar resources, and even establish permanent colonies on Mars (Taylor, “Private Companies and Space Law”). However, without clear international agreements on the management and equitable distribution of these resources, there is significant

potential for conflict, including the exploitation of space resources without regard for environmental protection or intergenerational equity. The evolving role of private industry in space exploration necessitates a more comprehensive legal approach to ensure space remains a domain for peaceful cooperation rather than a battleground for competing corporate and national interests.

Conclusion: The Need for Reform in Space Law

As human presence in space grows, it becomes increasingly evident that our existing legal frameworks—though foundational—are woefully inadequate to address the complexities of this new frontier. The Outer Space Treaty and the Moon Agreement were pioneering, but they were written in a time when the realities of rapid technological advancements and militarization of space were inconceivable. New treaties must be developed to address the evolving threats of dual-use technologies, space debris, and the protection of celestial bodies and astronauts. The increasing involvement of private companies in space exploration raises the stakes even further, as corporate interests could lead to the exploitation of space's resources at the cost of the environment and international stability. Space is no longer the final frontier—it is now an arena in which humanity's actions will define the course of future generations. The question is not whether we can preserve the peace in space, but whether we will choose to act decisively, before space becomes the next battleground of global conflict. The time to craft meaningful and enforceable international agreements is now. We must no longer view space as a vast, untamed frontier, but as a shared resource and domain that will either unite humanity or drive us further apart. The future of space exploration lies in our collective hands—not as a distant possibility, but as an



RUNNER UP | ESSAY

Applying International Humanitarian Law to AI-Driven Space Debris Management: Preventing Armed Conflict in Outer Space

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In 2021, a piece of space debris narrowly missed the International Space Station, forcing astronauts to take emergency shelter. This incident highlights the growing threat of orbital clutter and its potential to spark conflict in outer space. Space debris, a byproduct of human activities in orbit, has the potential to disrupt not only space operations but also critical communication systems, including those essential for International Humanitarian Law (IHL). IHL relies on telecommunication networks, especially in conflict zones (the “red zone”), to coordinate humanitarian efforts, monitor ceasefires, and protect civilians. However, the intentional destruction of satellites during hostilities can create vast amounts of debris, triggering a cascading effect known as the Kessler Syndrome. This phenomenon not only endangers the warring parties' own space assets but also threatens civilian satellites and spacecraft, effectively hindering future space operations for all nations. Such scenarios highlight the risk of a “space debris arms race”, where nations may hesitate to destroy enemy satellites due to the fear of generating debris that could harm their own systems.

To address these challenges, both space safety and space security

must be prioritized. Space safety ensures that no accidental incidents occur, while space security prevents deliberate actions that could escalate conflicts or trigger an arms race in space. As artificial intelligence (AI) emerges as a key tool for managing space debris, its dual-use potential raises critical legal and ethical questions under IHL. This essay explores how the application of IHL to AI-driven space debris management can prevent armed conflict in outer space and ensure the responsible use of AI technologies.

The Growing Threat of Space Debris

Space debris, often referred to as “space junk,” is a pressing issue that threatens the sustainability of outer space activities. It consists of defunct human-made objects orbiting Earth, such as old satellites, spent rocket stages, and fragments from collisions or anti-satellite (ASAT) tests. These objects, ranging from tiny screws to large satellite bodies, travel at staggering speeds of up to 28,000 km/h, posing significant risks to operational spacecraft and satellites. The Kessler Syndrome, a theoretical scenario proposed by NASA scientist Donald Kessler, illustrates

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The application of International Humanitarian Law (IHL) to AI-driven space debris management is essential to preventing the escalation of armed conflict and ensuring the responsible use of space technologies.

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the catastrophic potential of space debris. This phenomenon describes a chain reaction in which collisions between debris generate more debris, leading to an exponential increase in orbital clutter. If left unchecked, this could render key orbits unusable, jeopardizing global communication, navigation, and security systems.

The dangers of space debris extend beyond technical challenges; they also have profound implications for armed conflict. Debris can damage or destroy satellites, disrupting both civilian and military operations. For instance, the destruction of communication satellites could hinder humanitarian efforts in conflict zones, where telecommunication networks are essential for coordinating aid, monitoring ceasefires, and ensuring the safety of civilians. Moreover, space debris can be weaponized. Deliberate creation of debris through ASAT tests or kinetic attacks on satellites could disable enemy assets, but at the cost of generating long-lasting debris that harms all spacefaring nations. This dual-use nature of debris makes it a potential tool for asymmetric warfare, where weaker states or non-state actors could exploit debris to target stronger adversaries.

Historical examples underscore the risks of debris-generating activities. The 2007 Chinese ASAT test serves as a stark reminder of these dangers. By destroying one of its own satellites, China created over 3,000 pieces of trackable debris, many of which remain in orbit today, threatening other satellites and space missions. Similarly, the 2021 Russian ASAT test targeted a defunct satellite, producing over 1,500 pieces of debris that forced astronauts on the International Space Station to take emergency shelter. These tests highlight how debris-generating actions can escalate tensions and undermine global space security. They also

demonstrate the potential for such activities to trigger a “space debris arms race”, where nations hesitate to destroy enemy satellites due to the risk of harming their own assets.

Applying IHL to AI-Driven Space Debris Management

The application of International Humanitarian Law (IHL) to AI-driven space debris management systems is critical to ensuring that these technologies are used responsibly and do not exacerbate armed conflicts in outer space. IHL provides a framework for regulating the conduct of hostilities, including the use of advanced technologies like artificial intelligence (AI). Three key principles of IHL—distinction, proportionality, and precaution—are particularly relevant to the use of AI in space debris management.

The principle of distinction obliges parties to a conflict to distinguish at all times between military objectives and civilian objects, as well as between combatants and civilians, and to direct operations only against military objectives (Article 48, Additional Protocol I). This principle, recognized by the International Court of Justice (ICJ) as a “cardinal principle” of IHL (ICJ, Nuclear Weapons Opinion, paras. 78-79), also forms part of customary international law (Customary IHL Rules 1 and 7). In the context of AI-driven space debris management, this principle requires that AI systems be designed and programmed to differentiate between military satellites and civilian satellites. For example, an AI system tasked with removing space debris must avoid targeting operational civilian satellites, even if they are located in close proximity to military debris. Failure to uphold this principle could result in the unintended destruction of civilian infrastructure, such as communication or

weather satellites, with severe humanitarian consequences.

The principle of proportionality prohibits parties to a conflict from launching an attack “which may be expected to cause incidental loss of civilian life, injury to civilians, damage to civilian objects, or a combination thereof, which would be excessive in relation to the concrete and direct military advantage anticipated” (Article 51(5)(b), Additional Protocol I). In the context of AI-driven debris removal, this principle requires that the potential harm to civilian space assets be carefully weighed against the military benefits of removing debris. For instance, if an AI system is used to deorbit a defunct military satellite, it must ensure that the operation does not generate excessive debris that could harm civilian satellites or disrupt essential services like global navigation or disaster response. The challenge lies in programming AI systems to accurately assess and balance these risks, particularly in dynamic and unpredictable space environments.

The principle of precaution requires parties to a conflict to take constant care to spare the civilian population, civilians, and civilian objects when conducting military operations (Article 57(1), Additional Protocol I; Customary IHL, Rule 15). This principle entails obligations to take precautionary measures in attack and against the effects of attack. In the context of AI-driven space debris management, this means that AI systems must be designed to minimize the risk of collateral damage to civilian space assets. For example, AI algorithms used for debris tracking and collision avoidance must prioritize the protection of civilian satellites, even if this complicates or delays military operations. Additionally, parties must ensure that AI systems are transparent and accountable, allowing for human oversight and

intervention when necessary. This is particularly important given the potential for AI errors or biases to result in unintended harm.

Governance Gaps in Outer Space

Despite the existence of foundational treaties like the Outer Space Treaty (OST), significant governance gaps persist in the regulation of outer space activities. One major challenge is the lack of clarity in core principles. For instance, concepts such as “due regard” and “peaceful use” remain ambiguously defined, leading to inconsistent interpretations and applications. As Melanie K. Saunders (2021) and Cristian van Eijk (2022) have noted, the principles of freedom and equality in space often conflict, limiting the realization of equitable access and use of space resources. The notion of sovereignty further complicates matters. While the OST prohibits national appropriation of outer space, states retain jurisdiction over their space objects and activities, creating tensions between national interests and the collective good.

The concept of peaceful use is particularly contentious. While it is widely agreed upon in principle, its practical application is often disputed (Su 2022). For example, the development of dual-use technologies—such as AI-driven space debris management systems—blurs the line between civilian and military applications, raising questions about compliance with the peaceful use principle. Similarly, the increasing involvement of private actors in space activities, such as resource extraction and satellite servicing, has outpaced the development of clear international regulations. Domestic laws, which serve as the primary means of implementing OST principles, often offer conflicting interpretations. For instance, varying approaches to licensing and regulating private sector activities highlight the lack

of international consensus on the meaning of the OST’s ban on “national appropriation” (DePagter 2022).

Conclusion and Recommendations

The growing threat of space debris, the dual-use potential of AI-driven technologies, and the pervasive governance gaps in outer space underscore the urgent need for a robust and adaptive legal framework. The application of International Humanitarian Law (IHL) to AI-driven space debris management is essential to preventing the escalation of armed conflict and ensuring the responsible use of space technologies. However, the current legal landscape is marked by ambiguity, fragmentation, and jurisdictional overlaps, which hinder effective regulation and enforcement.

To address these challenges, states must work together to clarify ambiguous concepts in the OST, such as “due regard” and “peaceful use,” through multilateral negotiations and the development of supplementary agreements. Strengthening international cooperation is critical to addressing the transnational nature of space activities. States, international organizations, and private actors must work together to develop harmonized standards for space operations. Enhancing transparency and accountability is essential to building trust and ensuring compliance with international law. Mechanisms for monitoring and reporting space activities, particularly those involving AI and debris management, should be developed to promote transparency. Additionally, an international body could be established to oversee the implementation of space law and resolve disputes related to space activities.

The governance gaps arising from the overlap between space law, IHL, and other legal regimes must be addressed. A comprehensive legal framework should be developed to

ensure consistency and coherence across domains. States should also be encouraged to adopt domestic laws that align with international principles and promote the sustainable and peaceful use of outer space. Finally, the development and use of AI in space must be guided by ethical principles. Ethical guidelines should be established to ensure that AI technologies used in space debris management are transparent, accountable, and designed to protect civilian interests.

In conclusion, the sustainable and peaceful use of outer space requires a concerted effort to address the legal, ethical, and technical challenges posed by space debris, AI-driven technologies, and governance gaps. By clarifying core principles, strengthening international cooperation, and promoting ethical AI development, the global community can ensure that outer space remains a shared resource for the benefit of all humanity. ■

Get Involved with IHL at the American Red Cross

The American Red Cross proudly carries out the mission of educating the American public about International Humanitarian Law (IHL), a responsibility that stems from the Geneva Conventions and our Congressional Charter. This completely free program is led by more than 2,500 youth and adult volunteers, who help educate their communities about the importance of IHL in helping reduce suffering during times of armed conflict. Since 2020, Red Cross IHL volunteers have educated more than 250,000 Americans about IHL. The enduring legacy of IHL and its power to reduce the destructive effects of war hinges on broad public understanding and appreciation of these laws. You can make a difference in your community by joining our IHL mission!

The IHL Youth Action Campaign (YAC) is a free American Red Cross program that encourages youth and young adults (ages 13 to 24) to learn about the laws governing armed conflict and empowers them to promote understanding and appreciation for IHL in their community. Interested youth will become official American Red Cross volunteers and form and register YAC teams with as few as two students. These youth volunteers, known as YAC Advocates, receive free training on IHL fundamentals, including the laws specific to the annual YAC theme. Past themes have included education during armed conflict, protection of the environment, and protection of cultural property. After finishing their training YAC Advocate teams design their own outreach campaigns, which can include social media efforts, classroom seminars, hosting guest speakers, holding student contests, and more. YAC Advocates are encouraged to get creative in how they connect with their communities, while enjoying the support and guidance of fellow Red Cross staff and volunteers.

If you are interested in promoting IHL in your community as part of the IHL Youth Action Campaign, please contact your local chapter or send an email to IHLyouth@redcross.org and our team can help connect you to your local office. ■

“If I were to speak of war, it would not be to show you the glory of conquering armies, but the mischief and misery they leave in their tracks. Clara Barton

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