PROTECTING ESSENTIAL CIVILIAN SERVICES ON EARTH FROM DISRUPTION BY MILITARY SPACE OPERATIONS

EXECUTIVE SUMMARY

REPORT

ICRC

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Since the dawn of the space age, the two Cold War superpowers have used outer space for military purposes. First used for surveillance, communications and navigation purposes in the late 1950s and early 1960s, military space capabilities have undergone a major transition, particularly over the past few decades. The military use of space has evolved from mostly strategic applications (such as monitoring strategic capabilities, providing early warning, ensuring strategic command and control and verifying compliance with missile treaties) to – from the Gulf War onwards – providing direct tactical support to military operations, including intelligence, surveillance and communications, as well as weapons platform targeting and guidance. This transition has revived competition among major spacefaring nations to enhance their counterspace capabilities, which may be deployed for hostile purposes.

As military space capabilities have evolved, new applications and systems have also emerged in the commercial satellite sector – essentially driven by the same technological innovations. Growth in this sector has accelerated in recent years with the deployment of large constellations of communications and remote sensing satellites.

As commercial satellite services have improved, in terms of their capacity and level of sophistication, the armed forces have become important customers. Conversely, essential civilian services now rely on satellite systems, including systems owned and operated by military forces, such as global navigation satellite systems (GNSS), and commercial space systems. As a result, many of today's space systems are dual-use, simultaneously performing military and civilian functions. This intersection of military and civilian interests in space is a potential source of humanitarian concern. Military operations during armed conflicts increasingly rely on both military and commercial space systems - and will continue to do so in the future. This reliance increases the likelihood of those systems becoming military targets, with a significant risk of harm to civilians and humanitarian organizations that rely on the services provided by such systems.

Chapter 1 of this report offers an overview of the impact of evolving military and commercial space capabilities. While essential civilian services have become more reliant than ever on space-enabled services, the space systems providing those services are now exposed to an unprecedented threat from potential counterspace operations, owing to the military function of frequently dual-use systems.

Against this backdrop, chapter 2 outlines the military uses of outer space, including intelligence, surveillance and reconnaissance, communications and data relay, positioning, navigation and timing, and space situational awareness. Additionally, the report describes a range of military counterspace capabilities that have been developed and/or are likely to be deployed during an armed conflict: radio frequency interference affecting satellite communications; radio frequency interference affecting global navigation satellite services; interference to disrupt satellite command and control; cyber operations; attacks on satellite ground stations; laser dazzling of electro-optical imaging satellites; co-orbital anti-satellite attacks; and direct ascent kinetic interceptor attacks. The consequences of using these capabilities vary: capabilities such as radio frequency jamming and certain cyber operations have a temporary effect on satellite services, while direct ascent or orbital kinetic attacks can damage or destroy satellites or ground stations, and most likely generate large amounts of space debris with a potentially lasting knock-on effect on space systems necessary for the functioning of critical infrastructure in many countries.

Chapter 3 examines the increasing reliance of essential civilian services on space-enabled infrastructure. Space-enabled services are increasingly being integrated into numerous aspects of critical civilian infrastructure, including communications, energy, water and sanitation, transportation, food and agriculture, health care, financial services, disaster prevention and mitigation, emergency services and humanitarian relief operations. These essential civilian services are interdependent, which means that disrupting one may have a knock-on impact on others. In general, communications, navigation and remote sensing space systems comprise the space infrastructure necessary for delivering essential civilian services, as the first two underpin most essential services and the third is critical to services such as humanitarian relief, disaster prevention and mitigation, and agriculture.

Chapter 4 takes a close look at the reliance of humanitarian relief operations on space systems, especially in cases where the local civilian critical infrastructure is lacking, damaged or destroyed, including as a result of a natural disaster or armed conflict. Taking the ICRC as an example, the report demonstrates that navigation, communications and remoting sensing satellite services are used in all phases of humanitarian operations, from needs assessments to emergency aid delivery, and from disaster risk reduction to building resilience in protracted conflicts. As a consequence, the disruption of these satellite services would hamper humanitarian operations on which civilians affected by armed conflicts or disasters depend. The risk of civilian harm is exacerbated by the prevalence of dual-use commercial satellites. The impacts of disruptions depend on the type of counterspace capability involved, the type of civilian service affected, the degree of reliance on that service and the availability of alternatives. This report presents two hypothetical scenarios to illustrate the potential impact on humanitarian relief operations of attacks on satellite services during an armed conflict.

A hostile military operation against a space system would likely have both an immediate and a long-term impact on civilian essential services on Earth. Hostile operations against space systems providing essential space-based services would lead to temporary or permanent loss of function. Moreover, affected systems would lose or experience reduced access to the most useful orbital regimes as a result of the orbital debris generated by these military operations, which could cause unpredictable damage or destroy other space objects.

Chapter 5 of this report considers a range of debris-generating space activities. To date, three major causes of fragmentation events have been identified as responsible for creating the largest volume of space debris: kinetic ASAT (anti-satellite weapons) tests, accidental collisions of space objects, and spontaneous explosions of satellites and rocket bodies. Based on this information, it seems safe to assume that any kinetic attacks against space objects would potentially create far more debris than any other space activities. The report also demonstrates the debris-generating knock-on impacts of certain non-kinetic military space operations. Of all the Earth orbits, the low Earth orbit (LEO) is most exposed to the threat of the rapidly increasing space debris population. Kinetic military operations designed or expected to create a large amount of space debris and tests involving kinetic ASAT systems would significantly exacerbate the debris problem and bring

the scenario of LEO becoming "unusable" much closer to reality. Thus, the spectre of armed conflict that extends into space, involving debris-generating kinetic operations, casts a threatening shadow over space-based essential civilian services in all countries.

Chapter 6 of the report presents, by way of conclusion, a number of policy recommendations proposed by the authors and based on humanitarian concerns, to mitigate the potential civilian impact of disruptions to these essential services caused by disruptive or destructive military space operations.

Firstly, states need to recognize the critical role that outer space and certain space systems play in delivering essential civilian services, and to protect those systems by: reaching a common understanding on the satellites that are indispensable to delivering essential civilian services and safeguarding persons and objects protected under international law, including during armed conflicts; publicly identifying, announcing or otherwise indicating which space systems provide critical space-based services to civilians; and protecting space systems that provide critical space-based civilian services, such as the GNSS space segment.

econdly, in order to protect the above-mentioned space systems, states need to: publicly identify, announce or otherwise indicate space systems that provide critical space-based services to civilians, in doing so they should provide timely and detailed information on space systems that provide critical services to civilians; and, whenever feasible, physically or technically separate space systems and services (including satellites, communication links and ground stations, or parts thereof) used for military purposes from civilian ones.

Thirdly, states must collectively mitigate space debris and protect the space environment by: introducing a moratorium on debris-causing ASAT development, testing and use, as a first step towards outright prohibition; reducing the risk of armed conflict in space by working towards preventing the weaponization of space, including by agreeing on additional prohibitions or limits on certain military activities or weapons in outer space; and enhancing transparency and improving public sharing of space situational awareness information to limit the impact of debris on critical space-based services to civilians.

Lastly, there is a need to ensure the satellite services critical to humanitarian relief operations by publicly announcing or otherwise indicating which space systems humanitarian relief organizations are employing; advocating for an international space charter for humanitarian relief in times of armed conflict and other emergencies (analogous to the International Charter Space and Major Disasters); and providing humanitarian relief personnel uninterrupted multi-system access to satellite services to avoid the negative impact on humanitarian operations of disrupting the services of a specific satellite system.

MISSION

The International Committee of the Red Cross (ICRC) is an impartial, neutral and independent organization whose exclusively humanitarian mission is to protect the lives and dignity of victims of armed conflict and other situations of violence and to provide them with assistance. The ICRC also endeavours to prevent suffering by promoting and strengthening humanitarian law and universal humanitarian principles. Established in 1863, the ICRC is at the origin of the Geneva Conventions and the International Red Cross and Red Crescent Movement. It directs and coordinates the international activities conducted by the Movement in armed conflicts and other situations of violence.

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