The Foundations of Arms Control

For several decades, arms control, non-proliferation and disarmament have played a key role in many states' security and foreign policies. This learning unit provides a general introduction to the field and explains how arms control can help to promote international peace and security.

Christopher Daase
Peace Research Institute Frankfurt (PRIF)

Frank Kuhn
Peace Research Institute Frankfurt (PRIF)

Cite as: Christopher Daase and Frank Kuhn, "The Foundations of Arms Control" in EUNPDC eLearning, ed. Niklas Schoernig, Peace Research Institute Frankfurt. Available at https://eunpdc-elearning.netlify.app/lu-01/, last modified 4 December 2025

The EU Non-Proliferation and Disarmament eLearning Course aims to cover all aspects of the EU non-proliferation and disarmament agenda. It's produced by PRIF with financial assistance of the European Union. The contents of individual learning units are the sole responsibility of the respective authors and don't necessariy reflect the position of the European Union.

Funded by
the European Union

1. Theoretical foundations

A message from the authors

Hello. I am Christopher Daase and I am a professor of international relations at Goethe University Frankfurt and the deputy director of Peace Research Institute Frankfurt, Germany.

Hello. My name is Frank Kuhn and I am a doctoral researcher and project coordinator for the Cluster for Natural and Technical Science Arms Control Research at Peace Research Institute Frankfurt.

In this learning unit, we will provide you with an introduction to the foundations of arms control and explain how arms control can help to promote international peace and security. The first chapter covers the key concepts of arms control, non-proliferation and disarmament, as well as how they relate to each other. Moreover, we discuss humanitarian arms control, counterproliferation and critical perspectives such as gender.

In the second chapter, you will learn a bit about what arms control is meant to be controlling, i.e. weapons. We will show you the differences between weapons of mass destruction and conventional weapons, and explain why emerging technologies are particularly difficult to control.

In the third chapter, we discuss the many different forms that arms control can take. Here, you will find out more about the level of approach, legal aspects, the temporal dimension and factors of success, before going on to address how arms control works in practice by delving into the issues of verification and implementation. Lastly, we provide an outlook about the future of arms control in chapter five.

We hope that you enjoy our learning unit.

For several decades, arms control, non-proliferation and disarmament played a key role in many states' security and foreign policies.

Reagan Gorbachev signing INF on December 8, 1987
Courtesy Ronald Reagan Presidential Library

However, the arms control architecture that has been in place since the Cold War is unravelling.

Conventional arms control in Europe has all but expired. Strategic nuclear arms control between Russia and the United States is on life support, while China is expanding its nuclear arsenal and remains unwilling to discuss nuclear risk reduction measures, let alone join the United States in serious arms control negotiations. The Biological and Chemical Weapons Conventions are under pressure after the use of chemical agents in Syria, the poisoning of Russian dissidents and unfounded Russian allegations of biological weapons activities in Ukraine. Ballistic missiles, drones and cruise missile systems are proliferating around the world. Emerging technologies such as artificial intelligence undermine traditional forms of quantitative arms control. Even seemingly successful humanitarian arms control initiatives, in particular the Convention on Cluster Munitions and the Mine Ban Treaty, have been unable to curb the widespread and devastating use of anti-personnel landmines and cluster munitions during the war in Ukraine.

Considering the dire state of arms control in virtually every domain, what rationale is there for states and non-state actors to allocate resources for arms control? And what do we actually mean when we talk about arms control, non-proliferation and disarmament?

To understand what arms control means, we first need to go back to the roots of modern arms control theory and the concept of stability, which were developed in the 1960s. It is also important to grasp that not all forms of arms control are necessarily aiming for stability – some focus on the security of human beings instead.

After a deep dive into the various concepts of arms control, we describe the different weapons and weapon systems, including their subcomponents, which can be regulated using arms control. Moreover, we discuss the different forms arms control can take in practice, be it negotiated, multilateral treaties or unilateral, non-binding political commitments, going on to explain why verification is so important. Lastly, we assess the possible future of arms control.

Definition and objectives

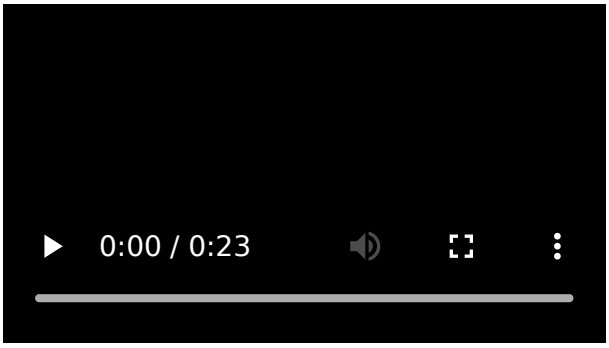
Arms control is often used as an umbrella term for arms control, non-proliferation and disarmament. Sometimes, these three concepts are also used interchangeably. They are, however, not the same.

Arms control is usually thought to encompass negotiated limits on or reductions in armaments with the aim of bringing about a stable equilibrium between two or more military powers and putting a brake on the arms race. In extreme cases, however, arms control

might even include rearmament to restore an equilibrium, but with limited rather than unrestricted growth rates.

Non-proliferation, on the other hand, aims to limit the number of states in possession of a particular type of weapon, rather than limiting the number of weapons. This includes obligating the possessor of a certain weapon (the 'haves') to refrain from supplying non-possessors (the 'have nots') with the respective weapons or related technology. Fundamentally, non-proliferation measures are therefore about maintaining the power of the possessor states over the rest of the international community and can be a point of contention between the 'haves' and the 'have nots'. Lastly, disarmament aims to eradicate weapons, or at least a specific type of weapon, ideally entirely. Disarmament can be both a desired end goal and a process leading to this end goal. Thus, every arms control agreement that brings about a reduction in armaments may also be described as disarmament.

To make things even more complicated, there are also additional subconcepts such as humanitarian arms control and counterproliferation that are playing an increasingly important role for international peace and security. Humanitarian arms control aims to improve the security and well-being of human individuals, rather than the security of the state, while counterproliferation involves a set of coercive measures to prevent states from acquiring specific military technologies.



While it is important to note that there is no universal definition of arms control, most scholars would agree that it includes all forms of cooperation between potential adversaries contributing to one or more of three overarching goals:

1. Reducing the likelihood of a hot war breaking out
2. Reducing the scope of violence if war occurs
3. Reducing the political and economic costs of being prepared for war

Which of these three goals is the most important is, however, up for debate, but people usually focus on the first, deeming the other two of lesser importance.[1]

Arms control is usually thought to entail diplomatic negotiation, with the outcome being a formal treaty between two or more state parties limiting or prohibiting certain weapons. But as we will show in this learning unit, it can in fact take many different forms, some of which may even be non-cooperative. For example, arms control may involve both reductions and increases in certain weapons, qualitative restrictions or changes in weaponry, different modes of deployment, or the regulation of existing weapon systems, yet it almost always aims to contribute to one or more of three core goals presented above.

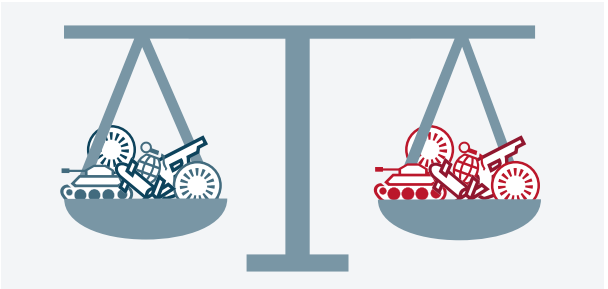
The three goals of arms control are not necessarily compatible with each other. If states spend money on military forces, communication systems or redeployments, which limit the chance of false alarms and misunderstandings in a crisis, then these measures could very well reduce the likelihood of war, but they would also entail significant financial investments in the military. Similarly, the merits of arms control do not always depend on whether or not the measures taken affect the size and composition of military forces. For example, hotlines for government-to-government communication – the so-called "red telephone", which actually never was a telephone but a Teletype –, can also reduce the risk of war, but they would leave the military balance largely untouched. The same is true for military deconfliction or improved intelligence that reduces the uncertainty about an adversary's military capabilities and doctrine.[2]

To understand how arms control, non-proliferation and disarmament can help reduce the likelihood of war, the scope of violence, and the political and economic costs of being prepared for war, we will now consider them each in a little more depth.

The trinity of arms control, non-proliferation and disarmament

Arms control

As set out above, the primary goal of arms control, as it is usually understood today, is to prevent or reduce the likelihood of the outbreak of war. This is generally done by maintaining stability.



Stability through numerical equilibrium
Grübelfabrik, CC BY-NC-SA

STABILITY

Stability can mean different things to different people, but it is most commonly used to describe a state in which nobody has the incentive to strike first – that is, to start a war. This is also what is meant by the term 'strategic stability'. The term 'crisis stability', in contrast, refers to the absence of incentives to strike

But why might states feel compelled to strike first? In his seminal article *The Reciprocal Fear of Surprise Attack*, written in 1958, Thomas Schelling explains how this might come about.

> If I go downstairs to investigate a noise at night, with a gun in my hand, and find myself face to face with a burglar who has a gun in his hand, there is danger of an outcome that neither of us desires. Even if he'd prefer just to leave quietly, and I'd like him to, there is danger that he may think I want to shoot, and shoot first. Worse, there is danger that he may think that I think he wants to shoot. Or he may think that I think he thinks I want to shoot. And so on. 'Self defense' is ambiguous, when one is only trying to preclude being shot in self defense.
>
> Schelling, Thomas C. 1958. "The Reciprocal Fear of Surprise Attack", P-1342. Santa Monica, CA: RAND Corporation, p.1.

This, Schelling concluded, is the problem of surprise attack. In an environment where striking first carries an advantage – and at the time this was widely assumed to be the case – a party might well feel tempted to do so if it feels that war could be imminent. Consequently, the primary goal of arms control would be to stabilise the whole situation by reducing incentives that may lead to war.[4]

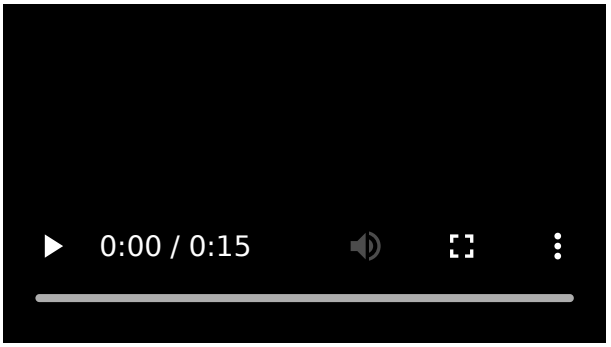
Strategic stability is not the only form of stability that arms control can help to maintain. Another form of stability is arms race stability, which refers to the absence of a largely unrestricted arms race. And to grasp how arms control might help constrain an arms race, we need to take a look at the security dilemma.

SECURITY DILEMMA

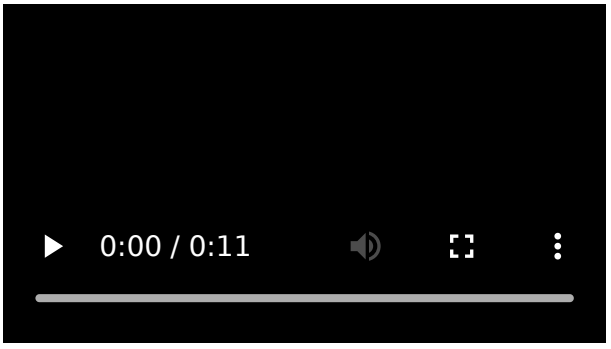
The security dilemma, sometimes also called the 'spiral model', rests on three basic assumptions. The first (neo-realist) assumption is that states are the principal actors in international politics. The second assumption is that the international system is what realists call an anarchic system, meaning that there is no central authority such as a world government or a world police which could guarantee security in the international system. Experts call this the '9-1-1 problem': If a state is attacked, it cannot call the police because a world police does not exist. The third assumption is that states can never be sure about other states' intentions – even if another state is in fact perfectly benign, one can never be entirely sure about its true intentions. Consequently, as Grieco put it in 1988: 'Today's friend may be tomorrow's enemy'.[5]

Since there is no central authority in world politics and one can never be sure about another state's intentions, states rely on self-help to guarantee their own security and survival. That is why the international system is often referred to as a self-help system.

However, self-help is not as straightforward as you might think. If state A builds up its military forces to ensure its own security, a neighbouring state B could misconstrue this benign arms build-up as a hostile act and decide that it must react to it. If the first state decides to increase its military spending once again, then an arms race might ensue. At best, such an arms race leads to the unnecessary accumulation of destructive and expensive weaponry. At worst, it might even lead to war.[6]

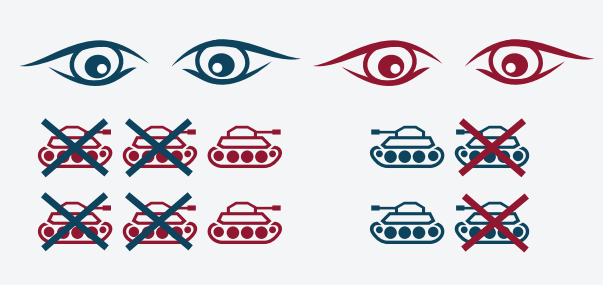


Arms control can help break this vicious cycle and ameliorate the security dilemma. It does so in two ways. Firstly, arms control measures often include quantitative or qualitative limitations on armament to constrain how far or in what direction an arms race might go.



Not only does this reduce the political and economic cost of the arms race. It can also lower the likelihood of war if a certain category of weapons that is considered particularly destabilising – that is, weapons which may invite a state to strike first due to their real or perceived military advantages – is regulated.

Secondly, arms control agreements frequently come with provisions that aim to increase transparency, thus diminishing the uncertainty about another state's intentions and military capabilities.



The security dilemma
Niklas Schörnig/Grübelfabrik, CC BY-NC-SA

Such CSBMs can include information sharing on missile flight data (telemetry), exchange of military

Non-proliferation

While arms control is usually concerned with restricting existing arsenals of weaponry both quantitatively and qualitatively, non-proliferation aims to limit the spread of certain weapons and weapons technologies, in particular but not exclusively nuclear weapons and nuclear technology, to other countries. Non-proliferation also serves the three overarching goals of arms control, but in a somewhat more indirect manner. For example, in the case of nuclear weapons, the underlying premise is that global security is better maintained when only a limited number of states possess such capabilities. This reduces the risk that a single actor might attempt to challenge the international status quo in a way that could escalate from regional conflict to full-scale nuclear war. But as can be seen in Learning Unit 12 `[/lu-12/]`, there are other regimes where the 'haves' pledge not to export other conventional weapons technologies to the 'have nots'.

Furthermore, non-proliferation helps to avert regional arms races as it seeks to prevent a situation in which one state acquires nuclear weapons and a rival in the neighbourhood feels compelled to catch up.

International non-proliferation initiatives have their roots in the 1950s and 1960s, when the United States and the Soviet Union joined forces to contain the global spread of nuclear weapons, recognising that it would be in their mutual interest to keep the number of nuclear weapon states as low as possible. One key motivation was to prevent West Germany from becoming a nuclear power. Eventually, US-Soviet collusion on nuclear non-proliferation resulted in the 1963 Limited Test Ban Treaty (LTBT) and the 1968 Treaty on the Non-Proliferation of Nuclear Weapons (NPT, see LU05) `[/lu-05/]`.[7]

TREATY

Treaty on the Non-Proliferation of Nuclear Weapons

Effective 05 April 1970 Legally binding 191 Member States

The Treaty on the Non-Proliferation of Nuclear Weapons (NPT) is a central part of the global effort to prevent the spread of nuclear weapons, promote cooperation in peacful uses of nuclear energy, and to further the goal of nuclear and general disarmament.

Current Adoption

AFG	AUS	AUT	BRB	BEL	BEN	BOL	BWA	BGR	BFA	CMR	CAN
TCD	COL	COG	CRI	CIV	CYP	COD	DNK	DOM	ECU	EGY	SLV
SWZ	ETH	FIN	GMB	DEU	GHA	GRC	GTM	HTI	HND	HUN	ISL
IDN	IRN	IRQ	IRL	ITA	JAM	JPN	JOR	KEN	KWT	LAO	LBN
LSO	LBR	LBY	LUX	MDG	MYS	MDV	MLI	MLT	MUS	MEX	MNG
MAR	NPL	NLD	NZL	NIC	NGA	NOR	PAN	PRY	PER	PHL	POL
KOR	ROU	RUS	SMR	SEN	SGP	SOM	LKA	SDN	SWE	CHE	SYR
TGO	TTO	TUN	TUR	GBR	USA	URY	VEN	YEM	ALB	DZA	AND
AGO	ARG	ARM	AZE	BHR	BGD	BLR	BTN	BRA	BRN	BDI	CPV
KHM	CAF	CHL	CHN	COM	CUB	PRK	DJI	GNQ	ERI	EST	FRA
GAB	GEO	GIN	GNB	GUY	VAT	KAZ	KGZ	LVA	LIE	LTU	MWI
MHL	MRT	FSM	MCO	MOZ	MMR	NAM	NRU	NER	OMN	PLW	PNG
PRT	QAT	MDA	RWA	KNA	WSM	STP	SAU	SYC	SLE	ZAF	ESP
PSE	TJK	THA	TLS	TKM	UGA	UKR	ARE	TZA	UZB	VUT	VNM
ZMB	ZWE	ATG	BHS	BLZ	BIH	HRV	CZE	DMA	FJI	GRD	KIR
MNE	MKD	LCA	VCT	SRB	SVK	SVN	SLB	SUR	TON	TUV	COK
IND	ISR	NIU	PAK	SSD							

□ Adopted by ratification
▒ Adopted by accession, acceptance, or succession
■ Not adopted

Data: United Nations Treaty Collection

Nuclear non-proliferation has been hugely successful, but this was not widely anticipated at the time. In 1963, US President John F. Kennedy warned `[https://www.armscontrol.org/factsheets/Timeline-of-the-Treaty-on-the-Non-Proliferation-of-Nuclear-Weapons-NPT#:~:text=March%2021%2C%201963%3A%20In%20a,may%20have%20%5Bnuclear%5D%20weapons]` that by the 1970s, as many as 25 states could have acquired nuclear weapons. Today, the actual number of nuclear weapon states is nine. The official nuclear weapon states are the United States, Russia, the United Kingdom, France and China. Unofficial nuclear weapon states are Israel, India, Pakistan and North Korea.

The fact that there has not been comprehensive nuclear proliferation since the invention of the atomic bomb is a testament to the NPT. The NPT sets forth that states who do not possess nuclear weapons will not acquire them, that nuclear weapon states will eventually pursue nuclear disarmament, and that all states are allowed to use nuclear technology for peaceful purposes. This is also known as the grand bargain. However, despite this arrangement, many analysts and policymakers were unconvinced that the NPT could work. Firstly, a multilateral treaty preventing

the spread of a powerful military technology was unprecedented. Secondly, a situation in which only a few countries were allowed to possess nuclear weapons, while others were not, was deemed unlikely to be sustainable over the long term.[8]

This points to one of the inherent problems of non-proliferation: It is always asymmetric. Some states are allowed to possess or acquire certain military capabilities (the 'haves'), but others are not (the 'have nots'). This asymmetry, which some may even call injustice, can lead to political disputes in the international arena that need to be managed diplomatically. One example is the NPT review conferences which take place every five years. You can find out more about the review conferences in Learning Unit 5.

Counter-proliferation

With the dissolution of the Soviet Union, some Western countries, and the United States in particular, started to see the proliferation of nuclear weapons and other weapons of mass destruction (WMDs) to terrorist groups and rogue states as an increasingly urgent threat to international peace and security. The fact that these actors were regarded as irrational and unreceptive to diplomatic initiatives gave rise to the concept of counter-proliferation.

In contrast to non-proliferation, which focuses on diplomatic measures, counter-proliferation comprises measures undertaken by law enforcement, intelligence agencies and the military to forestall or roll back the spread of certain weapons and weapons technologies. This may include the interdiction of illicit shipments, the freezing of financial assets, sabotage, covert action and the use of military force. One example of counter-proliferation is the Proliferation Security Initiative (PSI) initiated by the United States, which aims to interdict not only weapons of mass destruction, but also their delivery systems and other related items.

INSTITUTION

Proliferation Security Initiative (PSI)

Established 01 May 2003 115 Members

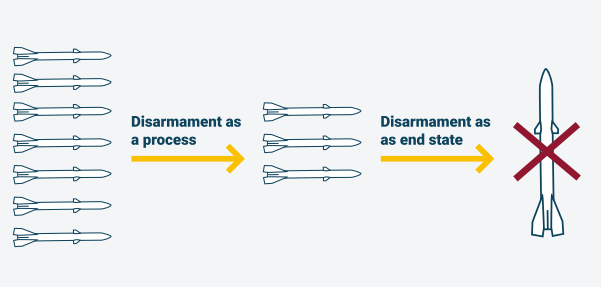
The Proliferation Security Initiative (PSI) was founded by the United States in May 2003 as a reaction to the 9-11 attacks. It aims at combating the proliferation of weapons of mass destruction (WMD), their delivery systems, and related materials and enhancing international cooperation in detecting, intercepting, and preventing the transport of these items. The US invited other states to join voluntarily.

Two prominent examples of counter-proliferation are the Israeli air strike on the Iraqi Osirak nuclear reactor in 1981 and the US-Israeli cyber operation against Iran's Natanz nuclear enrichment facility in around 2010. But while such measures may temporarily slow down proliferation, they are unlikely to have a lasting effect on a state's WMD program.[9]

Disarmament

Disarmament, the third relevant element, aims to serve the objectives of arms control not by maintaining stability or limiting the spread of certain weapons and related technologies, but by eliminating the weapons themselves. It may be understood both as an end state and as a process leading towards the eventual abolition of some or even all categories of weapons. Consequently, any reduction in military capabilities is usually considered disarmament, even if it does not directly lead to the total elimination of these capabilities.

The concept of disarmament differs significantly from arms control and non-proliferation because it considers weapons and arms races an independent cause of war. Its origins date back to the late 19th and early 20th century, but it particularly gained prominence after World War I, when the reduction of national armaments was considered necessary if not essential for creating peace and security. This was because of the widespread belief at the time that the arms race between the great powers had been a major contributor to the outbreak of the war. Weapons were considered the cause, not the result of insecurity.[10]



Disarmament process - endstate
Niklas Schörnig/Grübelfabrik, CC BY-NC-SA

Disarmament became an even more pressing issue during and after the Cold War because of the enormous destructive power of nuclear weapons. Since the employment of nuclear weapons would be catastrophic in every conceivable scenario, proponents of disarmament argue that the safest way to avoid such calamity would be to fully dismantle the world's nuclear arsenals. However, many scholars and practitioners contend that total nuclear disarmament is unlikely to succeed without radical political change at the international level.[11]

Humanitarian arms control and gender – A paradigm change

While arms control, non-proliferation and disarmament are first and foremost concerned about the security of the state, humanitarian arms control and gender approaches put the individual human front and centre.

Humanitarian arms control

With the rise of the human security paradigm that emerged following the end of the Cold War, humanitarian arms control has become an increasingly important element of arms control policy today. Humanitarian arms control attempts to alleviate human suffering by regulating weapons (or their use) that cause superfluous injury, do not discriminate between civilians and enemy combatants, and have a lasting impact even after a war has ended. In doing so, it directly contributes to the third core objective of arms control: reducing the scope of violence if war occurs.

Paradigm shift 'security'
Grübelfabrik, CC BY-NC-SA

For example, the Mine Ban Treaty of 1999, the Convention on Cluster Munitions of 2010 and the Arms Trade Treaty of 2014 were all motivated by humanitarian objectives (see Learning Unit 9 for more details) `[/lu-09/]`. Similarly, the Treaty on the Prohibition of Nuclear Weapons, which entered into force in 2021, has its origins in the humanitarian initiative, which stressed the catastrophic humanitarian impact that any use of nuclear weapons would necessarily entail.[12]

Mine clearance in the Western Sahara, 2010
[Martine Perret/UN]
(https://www.flickr.com/photos/unitednationsdevelopmentprogramme/13539962595/in/album-72157643214117825) (CC BY-NC-ND 2.0)

Nevertheless, it would be misleading to suggest that humanitarian arms control is purely a post-Cold War phenomenon. As a matter of fact, the use of explosive bullets in war was outlawed as early as 1868 in the Saint Petersburg Declaration, about a century before the notion of strategic stability was even conceived of. Moreover, the use of chemical and biological weapons was prohibited in 1925 by the Geneva Protocol. Lastly, the Convention on Certain Conventional Weapons (CCW), which entered into force in December 1983, restricts several conventional weapons that are considered to cause excessive injuries or have indiscriminate effects. This includes fragments which cannot be detected in the human body using X-ray, landmines, booby traps and incendiary weapons. In 1995, an additional protocol on blinding laser weapons was adopted, too. This shows that humanitarian arms control actually predates arms control, which is often considered the 'classical' or 'traditional' form of arms control today.

If you would like to know more about humanitarian arms control, please visit Learning Units 9 `[/lu-09/]` and 10 `[/lu-10/]`. We also have a learning unit dedicated to the history of arms control.

Feminism and gender

Feminist and gender approaches to arms control, non-proliferation and disarmament have helped to shed light on some questions that are not normally addressed in the mainstream discourse.

As these approaches have highlighted, women are almost always conspicuously absent in the highest national and international institutions of power. As a consequence, they have played no more than a marginal role in shaping arms control policies, even though these policies have a distinct impact on women's lifes that is often overlooked. For example, the proliferation of small arms and light weapons poses a particular threat to women and girls because it exposes them to various forms of gender-based violence. Feminist activists are therefore devoting a considerable amount of effort to promoting gender equality and increasing the participation of women on all levels of government, including in international organisations, to ensure that such issues are being addressed.[13]

The need to promote gender equality is, however, not the only conclusion drawn from feminist analysis. Because feminist and gender approaches pay special attention to discrimination and inequality, much critical feminist scholarship has emphasised how existing structures, theories and practices in international relations marginalise certain voices or forms of knowledge in public discourse. This can include the voices of those being affected by nuclear testing or forms of knowledge that challenge the conventional wisdom about the usefulness of nuclear deterrence. Feminists also frequently employ an intersectional approach, meaning that they take class, ethnicity, race, age, nationality and other potential forms of discrimination besides gender into account.[14]

Lastly, the gender perspective often identifies militarism and militarised national security structures, which may encompass the defence industry, national laboratories and the military, think tanks, politicians and even academic institutions, as a fundamental cause of conflict and insecurity.

> [T]he practice of war entails far more than the killing and destroying of armed combat itself. It

> requires the creation of a "war system," which entails arming, training, and organizing for possible wars; allocating the resources these preparations require; creating a culture in which wars are seen as morally legitimate, even alluring; and shaping and fostering the masculinities and femininities that undergird men's and women's acquiescence to war.
>
> Cohn, Carol/Ruddick, Sara. 2004. "A Feminist Ethical Perspective on Weapons of Mass Destruction", in: Hashmi, Sohail H./ Lee, Steven P. (eds) Ethics and Weapons of Mass Destruction: Religious and Secular Perspectives. Cambridge: Cambridge University Press, 405–406

Because arms control and non-proliferation tend to accept certain levels of armament as a legitimate response to international security challenges, many feminists promote total disarmament as the only way of achieving a more peaceful world – not unlike members of the peace movement and proponents of general disarmament. You can find out more about gender and disarmament in Learning Unit 16 [/lu-16/].

Summary

As we have seen in this chapter, the concepts of arms control, non-proliferation and disarmament essentially share the same objectives, but they derive from very different world views about the causes of war and peace. [15]

Overview of the concepts

Concept	Arms control	Non-proliferation	Disarmament	Humanitarian arms control	Feminism
Cause of war	Military instability and incentives to strike first	International actors (states) trying to upset the international order	Weapons and arms races are considered an independent cause of war	Does not try to reduce the likelihood of war but change how it is conducted	Militarism and militarised national security infrastructures
Remedy	Maintaining a stable military balance and removing first-strike incentives	Limiting the possession of certain weapons to only a handful of states	Eliminating all weapons or a specific category of weapons entirely	Banning weapons that have especially dire humanitarian consequences	Overcoming militarism, including general disarmament

Supporters of the respective concepts can vehemently disagree over how to achieve the three central objectives of arms control most effectively. However, policymakers, who often need to make decisions in a time-critical and uncertain environment, usually cannot afford to choose one concept over another, which is why they tend to implement various policies in tandem, even though this may seem contradictory.[16]

1. Brodie, Bernard. 1976. "On the Objectives of Arms Control", in: International Security 1 (1): 17–36, [https://doi.org/10.2307/2538574].
2. Schelling, Thomas C. /Halperin, Morton H. 2014. Strategy and Arms Control, reprint of the 1961 edition. Mansfield Centre, CT: Martino Publishing, 2.
3. Colby, Elbridge/Gerson, Michael S. (eds). 2013. Strategic Stability: Contending Interpretations. Carlisle, PA: Strategic Studies Institute and U.S. Army War College Press.
4. Schelling/Halperin, Strategy and Arms Control, 2
5. Grieco, Joseph M. 1988. "Anarchy and the Limits of Cooperation: A Realist Critique of the Newest Liberal Institutionalism", in: International Organization 42 (3): 485–507; Mearsheimer, John J. 2014. The Tragedy of Great Power Politics, Updated Edition. New York: Norton & Company.
6. Jervis, Robert. 1978. "Cooperation under the Security Dilemma" in: World Politics 30 (2), January: 167–214, [https://doi.org/10.2307/2009958].
7. Cameron, James. 2020. "What History Can Teach", in: Daedalus 149 (2), 1 April: 116–32, [https://doi.org/10.1162/daed_a_01793].
8. Gavin, Francis J. 2020. Nuclear Weapons and American Grand Strategy Washington, D.C.: Brookings Institution Press, 12.
9. Braut-Hegghammer, Målfrid. 2011. "Revisiting Osirak: Preventive Attacks and Nuclear Proliferation Risks", in: International Security 36 (1), July: 101–32, [https://doi.org/10.1162/ISEC_a_00046].
10. Webster, A. 2006. "From Versailles to Geneva: The Many Forms of Interwar Disarmament", in: Journal of Strategic Studies 29 (2), 1 April: 225–46, [https://doi.org/10.1080/01402390600585050].
11. Craig, Campbell. 2020. "Can the Danger of Nuclear War Be Eliminated by Disarmament?", in: Sauer, Tom/Kustermans, Jorg/Segaert, Barbara (eds): Non-Nuclear Peace, Cham: Springer International Publishing, 167–80, [https://doi.org/10.1007/978-3-030-26688-2_9].
12. Kmentt, Alexander. 2015. "The Development of the International Initiative on the Humanitarian Impact of Nuclear Weapons and Its Effect on the Nuclear Weapons Debate", in: International Review of the Red Cross 97 (899), September: 681–709, [https://doi.org/10.1017/S1816383116000059].
13. Wright, Susan. 2010. "Feminist Theory and Arms Control" in: Sjoberg, Laura (ed.) Gender and International Security: Feminist Perspectives, 1. publ, Routledge Critical Security Studies Series. London: Routledge, 191–213.
14. Cohn, Carol. 1987. "Sex and Death in the Rational World of Defense Intellectuals" in: Signs 12 (4): 687–718.
15. Mueller, Harald. 2017. "Arms Control and Arms Reductions in Foreign Policy." In Oxford Research Encyclopedia of Politics. [https://doi.org/10.1093/acrefore/9780190228637.013.391].
16. Maurer, John D. 2018. "The Purposes of Arms Control", in: Texas National Security Review 2 (1): 9–27, [https://doi.org/10.26153/TSW/870].

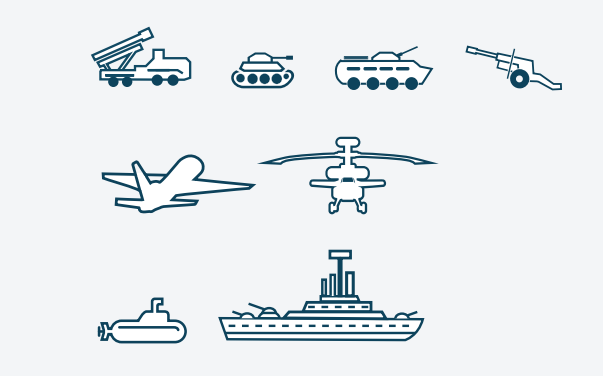
2. What to control? Types of weapons

Although some people might oppose all forms of weapons, even if they are used for legitimate self-defence, arms control is often based on the idea that specific types of weaponry are especially abhorrent, dangerous or – in arms control parlance – destabilising. These weapons therefore necessitate some form of control or even elimination. However, in order to determine which types are a particularly high risk for international peace and security, at least some knowledge about weapons is required.

So, how can we categorise different types of weapons?

One of the most fundamental distinctions is between conventional weapons and weapons of mass destruction, or WMDs, with the latter being 'capable of a high order of destruction or causing mass casualties', according to the U.S. Department of Defense Dictionary of Military and Associated Terms [LU01_E2_inhalte_grafiken_24022025_9_mm.svg]. Weapons of mass destruction include nuclear, radiological, chemical and biological weapons (see Learning Units 2 [/lu-02/], 3 [/lu-02/] and 4 [/lu-02/]). We discuss the different types of WMD in more detail below.

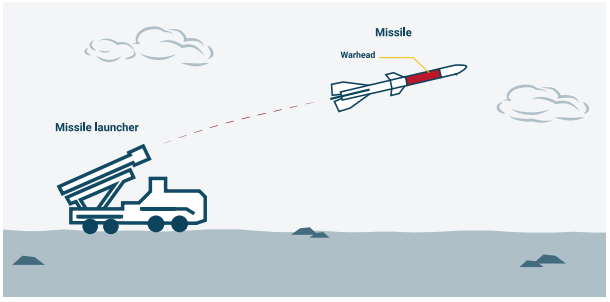
Conventional weapons encompass a much wider scope of different weapon systems. The United Nations Register of Conventional Arms, for example, includes seven different categories of conventional weapons.



Missiles and missile launchers, Battle tanks, Armoured combat vehicles, Large calibre artillery systems, Combat aircraft, including manned and unmanned aerial vehicles, Attack helicopters, Warships
https://www.unroca.org/categories Grübelfabrik, CC BY-NC-SA

Small arms and light weapons (SALWs, see LU10 [/lu-10/]), which include rifles, heavy machine guns, anti-tank weapons and portable missile launchers, are an additional category.

Many, although not all weapon systems can be further divided into subcomponents, all of which may be subject to control. This is best illustrated by looking at the category of missiles and missile launchers (see Learning Unit 7 for more details) [/lu-07]. The warhead, also called the 'armament section' is a crucial component of the missile and responsible for killing the target.



Missile and missile launcher
Grübelfabrik, CC BY-NC-SA

The warhead can be equipped with various payloads, including conventional explosives, a nuclear physics package in the case of a nuclear weapon, or chemical and biological warfare agents.

The missile carries the warhead to its designated target. This is why missiles are often referred to as 'delivery vehicles'. If a missile carries multiple warheads, it also contains what is known as a 'bus', which is propelled into space by the missile to release the warheads. Lastly, a missile must be fired from some sort of launcher, which can be either stationary or mobile, as in a missile silo or a mobile missile launcher. Each type of weapon and each subcomponent can be subject to various forms of arms control.

Weapons of mass destruction

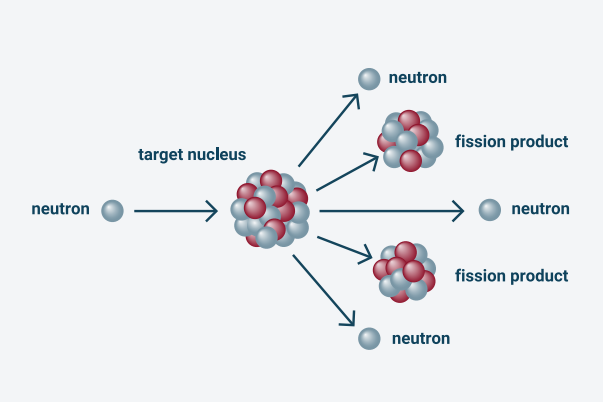
There are many definitions of the term 'weapons of mass destruction', or WMD, that is, but the authorative one was provided by a committee of the United Nations in as early as 1948.[1]

This definition states that WMD are:

> ...atomic explosive weapons, radio active material weapons, lethal chemical and biological weapons, and any weapons developed in the future which have characteristics comparable in destructive effect to those of the atomic bomb or other weapons mentioned above.
>
> Commission on Conventional Armaments (CCA), UN document S/C.3/32/Rev.1, August 1948, as quoted in UN, Office of Public Information, The United Nations and Disarmament, 1945–1965, UN Publication 67.I.8, 28

As this definition shows, we can distinguish between four types of WMD.

Nuclear weapons
Nuclear weapons use nuclear fission, as seen in atomic bombs, or nuclear fusion, which powers thermonuclear weapons to produce blast, heat, radiation and radioactive fallout. All of these effects cause widespread destruction and significant casualties.



Nuclear fission
Grübelfabrik (CC BY NC)

Radiological weapons
Radiological weapons use conventional explosives to disperse radioactive material in order to cause radiation sickness, which, depending on the radiation exposure, can be fatal. Radiological weapons do not involve nuclear fission or nuclear fusion.

Chemical weapons
Chemical weapons are substances designed for military use, capable of causing death, serious injury or incapacitation through their physiological effects. The term chemical weapon typically encompasses both the chemical agent itself and the munition employed to disperse it.

Biological weapons
Biological weapons are living microorganisms such as viruses, bacteria or fungi that are released with the intent to cause disease in humans, animals or plants. Toxins which are derived from microorganisms are also considered biological weapons.

Although the term WMD is well established and widely used today, it is not without its critics. As some scholars have argued, neither chemical nor biological weapons come close to the destructiveness of nuclear weapons. Moreover, states can defend against both chemical and biological attacks by issuing protective gear and containing the spread of biological agents through public health measures, as could be witnessed during the COVID-19 pandemic. Likewise, doctors and medical personnel can treat victims of biological attacks. In this sense, the only true weapon of mass destruction are nuclear weapons.[2]

Preventing the use of WMDs has received significant political attention. But in fact, they are not the weapons that cause most of the harm in conflicts worldwide. As the former United Nations Secretary-General Kofi Annan argued in 2000:

> In terms of the carnage they cause, small arms, indeed, could well be described as "weapons of mass destruction".[3]
>
> Annan, Kofi. 2000. We the Peoples: The Role of the United Nations in the Twenty-first Century

As a result, some even go so far to call small arms and light weapons the real weapons of mass destruction.

Conventional weapons

In contrast to weapons of mass destruction, conventional weapons are used extensively in armed conflict around the globe. You can find more information about some of the most commonly used conventional warheads below.

Blast fragmentation warheads
The majority of artillery shells and aircraft-delivered bombs utilise blast fragmentation warheads. These warheads consist of a metal casing filled with explosives, generating substantial shrapnel in addition to the blast wave.

High-explosive anti-tank (HEAT) warheads
Most anti-tank guided weapons are equipped with high-explosive anti-tank warheads. These warheads feature a specifically shaped explosive known as a shaped charge which, upon detonation, generates a high-velocity metal jet capable of penetrating even the thickest armour.

Thermobaric warheads
Thermobaric warheads are particularly devastating when used against enclosed structures like caves or complexes with multiple rooms. Typically, they comprise two charges: the first disperses an aerosol, composed of fuel or fine metal particles, while the second ignites it. This sequence results in a sustained blast wave, as the ensuing explosion consumes much of the available oxygen in the surrounding area.

Cluster munitions
Cluster munitions are intended to inflict damage across expansive areas. Essentially canisters, they disperse smaller submunitions, often referred to as bomblets, which target enemy troops or vehicles on the battlefield. However, due to the high dud rate of many cluster munitions, these bomblets frequently remain unexploded on the ground, posing long-term risks to civilians. Consequently, the use of cluster munitions is prohibited under the Convention on Cluster Munitions.

Kinetic energy warheads
Kinetic energy warheads kill their targets only through kinetic energy – they do not contain any explosive charges. One of the most basic kinetic energy projectiles is a bullet fired by a pistol or rifle. However,

kinetic energy warheads, also known as 'hit-to-kill', are commonly used in air and ballistic missile defence as well.

Even though all of these warheads are conventional, they still result in significant levels of destruction – especially if used in urban terrain.

Emerging disruptive technologies

In contemporary discussions about weapons technology, emerging disruptive technologies (EDT, see LU15 for more information) [/lu-15/] are gaining more and more prominence. This umbrella term describes a number of technologies, many of which are still in development, that have the potential to affect the international balance of power and transform the way that wars will be fought in the future. However, precisely because they are still in the development phase, it is often unclear whether and to what extent their potential can be realised.

Some examples of emerging technologies are:

Artificial intelligence (AI)
Artificial intelligence could be used in autonomous weapon systems and battle management systems, thereby increasing the speed of warfare beyond meaningful human control.

Quantum technology
Quantum computers could provide their users with powerful code-breaking capabilities to decrypt enemy communications. Quantum sensors could be used to detect submarines.

Directed energy weapons
Directed energy weapons can be used to affect a target without relying on a projectile. One example is laser technology, which could improve air and ballistic missile defence.

Synthetic biology
Synthetic biology could be used to develop novel materials for military applications and biofuels, as well as to improve medical treatments.

You can find more examples of EDTs in Learning Unit 15 [/lu-15].

As you can see, not all emerging disruptive technologies are weapons. However, even those that are not could still have a significant impact on international affairs. What is more, EDTs pose a special challenge to arms control because they are often intangible and thus cannot be constrained in the same way as weapons of mass destruction or conventional weapons.

In the next section, you will learn more about the different forms of arms control and how various types of weapons can be controlled.

1. Carus, W. Seth. 2012. *Defining "Weapons of Mass Destruction"*, Center for the Study of Weapons of Mass Destruction Occasional Paper 8. Washington, D.C.: National Defense University Press, [https://doi.org/10.21236/ADA577317].
2. Enemark, Christian. 2011. "Farewell to WMD: The Language and Science of Mass Destruction", in: Contemporary Security Policy 32 (2), 1 August: 382–400, [https://doi.org/10.1080/13523260.2011.590362].
3. [https://www.warpp.info/en/m5/articles/small-arms-and-light-weapons-the-real-weapons-of]

3. How to control? Forms of arms control

In the previous two sections, we have learned what the objectives of arms control are, as well as what concepts and what kind of weapons exist. We will now take a look at the different forms that arms control can take once states parties have agreed on the course of action and the weapon system they would like to control.

Depending on the objective and the weapon system, various forms arms control are possible.

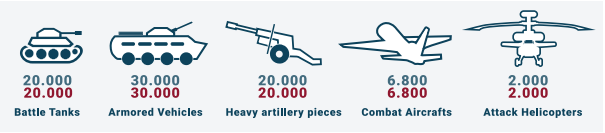
Quantitative and qualitative arms control

Quantitative limits

Firstly, if the objective is arms control, one common form is to place a quantitative limit on the overall number of weapon systems or their subcomponents. One example of this is the New START Treaty between the United States and the Russian Federation [/lu-05]. The treaty will expire in February 2026, but until then, it will limit the two states' nuclear arsenals as follows:

- Deployed delivery vehicles: 700
- Deployed warheads: 1,550
- Deployed and non-deployed launchers: 800

As you can see, New START limits delivery vehicles, warheads and launchers. Another example is the now defunct Conventional Forces in Europe (CFE) Treaty [/lu-11/], which entered into force in 1992 and limited the conventional forces of NATO and the Warsaw Pact. Each side was limited to:

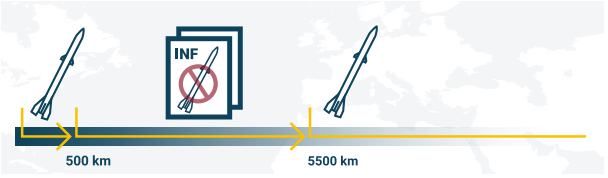


Limitations of NATO and the Warsaw Pact
Grübelfabrik (CC BY NC)

Obviously, if the goal is the total elimination of a specific weapon system, this is essentially also a quantitative approach, with the limit set at zero.

Qualitative restrictions

The second option for arms control is qualitative restrictions, which focus on certain properties of weapon systems. For example, the Intermediate-Range Nuclear Forces (INF) Treaty banned US and Soviet nuclear and conventional ground-launched ballistic missiles and cruise missiles with a range between 500 and 5,500 kilometres.



The Intermediate-Range Nuclear Forces (INF) Treaty limits the range of conventional ground-launched ballistic missiles and cruise missiles
Grübelfabrik (CC BY NC)

The property that was controlled in this case was missile range. Qualitative restrictions also play an important role when it comes to the regulation of emerging disruptive technologies. Autonomous functions in weapon systems, for example, are intangible and cannot be counted.

If the goal is non-proliferation, then the tool of choice is usually export controls. Export controls seek to prevent the spread of certain weapons or technologies around the globe by controlling the export of specific goods. Some examples of export control regimes are:

- Australia Group (chemical and biological weapons)
- Missile Technology Control Regime (missiles and missile technology)
- Nuclear Suppliers Group (nuclear materials and technology)
- Wassenaar Arrangement (conventional weapons and dual-use items)
- Zangger Committee (nuclear materials and technology)

You can learn more about these regimes in Learning Unit 12 [/lu-12].

Actors involved

When we think of arms control, we usually think of two adversaries agreeing on common ceilings for weapon systems. This is the typical understanding of arms control from the Cold War. But it is not the only form. Arms control measures vary along three lines: 1. the actors involved, 2. the normative status of the agreements and 3. the point in the arms cycle at which the measures are taken. Arms control measures can be taken by one, two or more actors, i.e. they can be unilateral, bilateral or multilateral.

Unilateral arms control

Unilateral arms control measures are those a state takes independently, without consulting the opponent, to restrict its own armaments. The aim of such measures may be to signal peaceful intentions and the possibility of joint agreements to the opponent. They are a goodwill gesture and communicate, at least

implicitly, the expectation that the opponent will reciprocate or is willing to cooperate.

However, it is often unclear whether unilateral arms control initiatives are motivated by genuine arms control concerns or by technological and financial difficulties. One aim of unilateral measures may be for a state to deter an opponent from engaging in arms efforts until their own capabilities have grown to such an extent that lifting the restrictions would give them significant advantages. However, ethical, political or economic reasons can also lead to unilateral arms control measures.

In the late 1980s, South Africa ended its nuclear weapons programme and became the first country to unilaterally eliminate all of its nuclear capabilities. After the end of the Cold War, the United States removed thousands of tactical nuclear weapons from Europe without demanding the same of the Soviet Union. And in the same year, Russia and the United States declared unilateral moratoria on nuclear testing, which were later incorporated into the provisions of the Comprehensive Nuclear Test-Ban Treaty (CTBT) in 1996.

Critics have objected to unilateral measures, claiming that they are dangerous because opponents could exploit them. However, many bilateral and multilateral arms control negotiations have only become possible because unilateral action paved the way.

Bilateral arms control

Bilateral arms control prevailed during the Cold War and also dominates arms control theory to this day. It is based on negotiations between two actors to regulate or completely prohibit the development, production, deployment or use of certain weapon systems. The aim is to establish a stable and predictable relationship between two adversaries. Two properties characterise bilateral arms control: reciprocity, i.e. the symmetry of the agreements entered into, and verification, i.e. the existence of mechanisms for monitoring compliance through inspections or similar procedures (for more on verification, see Section 4 below).

After the US lost its nuclear supremacy in the 1950s and the Cuban Missile Crisis almost resulted in a nuclear catastrophe, the US and the Soviet Union agreed to bilateral negotiations to reduce the risks of nuclear armament. In 1972, two important arms control treaties were concluded: the ABM Treaty to reduce anti-ballistic missiles and the SALT I Interim Agreement to limit strategic, i.e. intercontinental nuclear weapons. In the period that followed, bilateral arms control treaties were also concluded for other weapon systems (e.g. the 1987 Intermediate-Range Nuclear Forces Treaty, or INF Treaty) – you can find more information on these treaties in Learning Units 5 and 20. Regional powers such as India and Pakistan have also entered into bilateral agreements to stabilise their security relations.

The challenge of bilateral arms control is to overcome the dilemma of mistrust and fear that the opponent might cheat and gain a unilateral advantage from the agreement. To counter this risk, monitoring and verification measures must be agreed, although these in turn require each party to be transparent regarding their own capabilities and deployment plans, at least to a certain extent.

Multilateral arms control

Multilateral arms control refers to agreements, treaties or measures of three or more countries that regulate, reduce or eliminate certain weapon systems or military activities. Their goal is usually to increase global or regional security and stability, to prohibit or restrict the proliferation of dangerous weapon systems. The main challenge of multilateral arms control is that parties of different sizes and strengths, ideological orientations and military power must agree on joint measures. These problems plagued the ultimately unsuccessful Mutual and Balanced Force Reduction in Europe (MBFR) talks during the Cold War, in which the member states of NATO and the Warsaw Pact engaged for 16 years. It was only at the end of the Cold War that limits for the number of heavy weapon systems that could be stationed between the Atlantic and the Urals were agreed in the CFE Treaty of 1990. Similar difficulties were encountered by the UN Conference on Disarmament, which dates back to an agreement between the United States and the Soviet Union in 1962 and has not had any major successes since the ban on chemical weapons in 1997. The most important multilateral arms control agreement is undoubtedly the Nuclear Non-Proliferation Treaty (NPT), which, as mentioned above, restricts the possession of nuclear weapons and obliges the nuclear weapon states to negotiate nuclear disarmament in good faith.

The current crisis of the NPT is a prime example of how the issues of different state interests, the lack of

universality due to unequal and incomplete participation, and difficulties of compliance and enforcement become particularly noticeable in multilateral arms control negotiations. Yet, the increasing multipolarity of the international system requires a turn towards precisely such multilateral arms control in the future.

Legal status

In terms of International Relations theory, arms control is a collaboration game. This means that even after an agreement has been reached, all parties have an incentive to exploit others' willingness to cooperate by cheating or free-riding. To reduce this risk, arms control agreements need strong provisions for monitoring compliance and sanctioning misbehaviour. This is the reason why many arms control proponents favour strongly institutionalised arms control regimes based on international treaties duly ratified by national legislators. The expectation is that legally negotiated agreements reduce ambiguities, specify possible sanctions, increase domestic political commitment and thus ensure greater willingness to comply.[1]

Non-binding agreements

However, not all arms control agreements are based on international treaties. Some are informal or, as jurists say: non-binding agreements. They might still be politically binding, but have no legal basis on which states could demand or enforce compliance. There are a number of reasons why states might prefer informal to formal agreements:

- They might want to reach an agreement quickly, for example in the event of an impending crisis or where new technologies require swift action.
- They might be seeking to avoid subsequent renegotiation if a situation is volatile and complex.
- They might want to avoid a ratification process if the agreement is controversial domestically.
- They may want to avoid overly stringent requirements and keep the option of withdrawing from the agreement open in the event that conditions change.

But flexibility has its price. The downside of informal agreements is their lack of legal obligation.[2]

Behavioural arms control

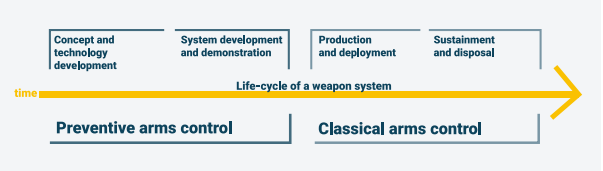
In addition to informal arms control agreements that have been negotiated but never legally formalised, such as the CTBT (which has never been ratified), there is another type of arms control that is even less tangible because it does not even arise from negotiations or talks, but from political practice, tacit understandings and shared expectations. This so-called behavioural arms control consists of emergent customs and tacit norms that constrain presumably inappropriate military behaviour, such as naval operations conducted too close to another party's shores, to reduce the risk of accidental escalation.

Lack of trust

While international law can play an important role in arms control, not all arms control agreements need to be legal in character. International law itself is based on an obligation to comply with international rules. Where trust between states has been so severely undermined that even the non-legal foundations of international law are not recognised, less formalised forms of cooperation must be used to ensure basic arms control.

Preventive arms control

Arms control can start at different points in time during the military acquisition process. Most arms control agreements were negotiated only after weapons had already been deployed. However, it is also possible to regulate weapons even before they enter the production and deployment phase. This is known as preventive arms control. [3]



Grübelfabrik (CC BY NC)

Because states are usually reluctant to agree to limitations on military technology that may provide them with an advantage, preventive arms control has been rare. Since the United States withdrew from the Anti-Ballistic Missile (ABM) Treaty in 2002, there is only one arms control agreement left that could be reasonably considered preventive: the Outer Space Treaty, which prohibits the deployment of weapons of mass destruction in space (for more details on this see Learning Unit 8 `[/lu-08/]`).

Cooperation vs coercion

Arms control is usually seen as a form of cooperation, where actors reach some form of compromise or agree on joint action regarding their military programmes. However, power and pressure have always played a role in arms control negotiations and subsequent regimes. What is more, since the end of the Cold War, non-cooperative or coercive arms control has emerged as a distinct field of global governance.[4]

Coercive arms control is the exercise of political, economic or military power by states, groups of states or international organisations in order to limit or prohibit another state or group of states or non-state actors to acquire, develop or use certain weapon systems. Coercive arms control can be applied with a broad mandate from an international organisation, as was the case with the UN's economic sanctions against North Korea used to pressure the country to

abandon its nuclear weapons programme. However, so-called 'coalitions of the willing' have also used military force without such a mandate, e.g. in Libya and Iraq (2003) to compel them to dismantle their WMD capabilities after sanctions were deemed ineffective. Even Israel's air strikes against nuclear facilities in Iraq (1981) and Syria (2007) have been justified as coercive arms control measures.

If carried out without proper legal justification, coercive arms control measures violate the principles of sovereignty and the non-use of force and can undermine regional and global stability. Their effectiveness has also been questioned, since coercion tends to provoke resistance. However, when states systematically violate international treaties or humanitarian norms, some form of coercive arms control may be necessary to maintain the international order.

Factors for success

Whether arms control is successful or not depends on a variety of factors, and there is no agreement on the conditions under which arms control will automatically lead to certain success. However, there are factors that influence the chances of successful arms control in one direction or another. Some of the most important are:

International politics

Succesful arms control between major powers usually requires a shared understanding about their position in the international order. Moreover, it is important that they are able to manage key regional questions underpinning their geopolitical competition, such as the division of Europe into two blocs during the Cold War.[5]

Domestic politics

Besides the international political environment, the domestic political landscape also needs to be conducive to arms control. This often means that there must be a willingness to limit military spending as a means to reduce pressure on the overall budget. In democratic societies such as the United States, this pressure has primarily come from U.S. Congress, but also from civil society. In the autocratic systems of Russia and China, however, there are no counterparts to these entities.[6]

Leadership

Individual leaders and their conceptions about the world can also play an important role for the success of arms control. American president Ronald Reagan and Soviet leader Mikhail Gorbachev, for example, shared a common understanding about the dangers of nuclear war, paving the way for significant reductions in the two states' nuclear arsenals at the end of the Cold War. If Gorbachev, who was open to reforming the USSR and rethinking its role in the international system, had not become leader of the Soviet Union in 1985, the Soviet Union might never have negotiated the INF Treaty with the United States. In a similar vein, Gorbachev needed a partner in the White House who was also open to negotiating nuclear reductions and found him in the form of US president Ronald Reagan.[7] The INF Treaty is therefore a good example of the importance of leadership in arms control.

Technology

Technology is another important factor that impacts the prospects of arms control. It is widely believed that arms control is most challenging when offensive technologies have the upper hand, while defensive technologies are conducive to arms control. Yet, it is extremely difficult to categorise weapons as either offensive or defensive because most of them can be used for both purposes. Nevertheless, it is probably fair to say that the prospects of successful arms control hinge on the perceived military utility of a technology, regardless of whether it may be used offensively or defensively. The substantial reductions in US tactical nuclear weapons after the Cold War, for instance, were driven to a not insignificant extent by the realisation of military leaders that these weapons would be an obstacle to conventional military dominance on the battlefield.[8]

The nature of the weapon

Certain weapons being considered particularly inhumane or morally repugnant can also help to spur arms control initiatives. Anti-personnel mines, for example, were long considered to be militarily useful. Yet, NGOs succeeded in bringing about a change in thinking by focusing on the human suffering these weapons cause, particularly for a country's civilian population. The result was the Ottawa Treaty, also known as the Mine Ban Treaty. Only a few countries – including major military powers – still refuse to sign this treaty. Cluster munitions were banned under the Oslo Convention for similar reasons. However, this framing does not always succeed. Despite strong campaigns against armed drones in the 2010s, for instance, states considered the military benefit of these weapons to be so great that no restrictions on their use, let alone a ban, could be enforced internationally.

Moreover, the increased likelihood of a high-intensity military conflict on NATO's eastern flank after Russia's full-scale invasion of Ukraine has prompted some governments to reconsider their position regarding the Mine Ban Treaty and the Convention on Cluster Munitions. In 2025, five European countries – Estonia, Latvia, Lithuania, Poland, and Finland – withdrew from the Mine Ban Treaty.

Another factor that is often referred to as a prerequisite for successful arms control is trust. But is it really as important as is often asserted? In the following section, you will learn more about the role of trust in arms control.

1. Weber, Steve. 1991. Cooperation and Discord in U.S.-Soviet Arms Control, vol. 166. Princeton University Press, [https://doi.org/10.2307/j.ctt7zv7m4].
2. Lipson, Charles. 1991. "Why Are Some International Agreements Informal?", in: International Organization 45 (4): 495–538.
3. Altmann, Jürgen et al. 1998. "Preventive Arms Control as a Prerequisite for Conversion of Military-Related R&D", in: Reppy, Judith (ed.), Conversion of Military R & D. London: Palgrave Macmillan UK, 255–71, [https://doi.org/10.1007/978-1-349-14886-8_17].
4. Daase, Christopher/Meier, Oliver. 2012. "The Changing Nature of Arms Control and the Role of Coercion", in: Arms Control in the 21st Century. Routledge, 233–41.
5. Barrie, Douglas/Wright, Timothy (eds). 2022. MDI Missile Technology: Accelerating Challenges. London: The International Institute for Strategic Studies, [https://www.iiss.org/publications/strategic-dossiers/mdi-missile-technology-accelerating-challenges].
6. Barrie and Wright.
7. Colbourn, Susan. 2023. "Arms Control and Deterrence: The Euromissiles, Then and Now", HCSS Programme on Strategic Stability: Deterrence and Arm Control. The Hague: The Hague Centre for Strategic Studies, March, 4, [https://hcss.nl/wp-content/uploads/2023/03/03-Colbourn-Arms-Control-and-Deterrence-Euromissiles.pdf].
8. Koch, Susan J. 2012. The Presidential Nuclear Initiatives of 1991-1992, Center for the Study of Weapons of Mass Destruction Case Study

4. Verification and implementation

Verification

When it comes to formal arms control, 'verification' is one of the most prominent concepts. In general terms, it refers to the processes and mechanisms used to ensure that parties (usually states) comply with the terms of the respective arms control agreement. This usually includes monitoring (e.g. with satellites or seismic monitoring devices), inspections and visits by foreign inspectors (sometimes planned well in advance, sometimes spontaneous), data sharing with inspectors (which they can then compare with their own findings) and other measures to detect and prevent violations.

In an ideal process, verification promotes trust and transparency between the signatories. It aims to provide confidence that all parties are fulfilling their commitments, that all parties are compliant and that no party is secretly violating the agreement. The aim of verification is therefore to help make arms control possible in the first place. It does so by protecting the states from having their willingness to cooperate exploited. By verifying whether the other side is adhering to the agreement they entered into, each side can engage in cooperation with peace of mind. However, even a very intrusive verification regime cannot guarantee compliant behaviour of the other side with 100-percent certainty. That being said, at the very least, extensive verification measures can drive up the costs of secretly violating the agreement. But how much verification is feasible and acceptable? Visit the other learning units to see how the issue of verification is handled in the respective field.

In general, verification walks a fine line between politically desirable transparency and politically undesirable espionage. Therefore, a minimum of trust is also necessary for verification.[1]

This means that even the most sophisticated and stringent verification measures will not create the trust necessary for arms control if the starting point is complete mistrust and the assumption that states would only enter into agreements in order to exploit them unilaterally. The findings of research on verification theory are therefore paradoxical. Intrusive, far-reaching verification measures can apparently be used when a certain relationship of trust already exists, i.e. when intrusive and far-reaching verification measures are actually no longer necessary. Conversely, such measures would in fact be important where they are least likely because there is insufficient trust to introduce them.

Even if a base level of trust does exist, a number of other challenges make verification difficult. Some activities are difficult to detect, especially if they are deliberately hidden and the existing verification mechanisms intentionally undermined. Others are difficult to interpret, especially if dual-use technology is used and agreements are vague as to what activities are permitted or prohibited. Lastly, verification is expensive and requires the latest technologies to keep pace with innovation in weapons technology.

States have developed a range of methods to overcome mistrust and enable verification. These include the use of national technical means (NTMs) for independent verification, e.g. through satellites or airborne sensors; an agreement to share reports and data; and on-site inspections to verify compliance on the ground. In some cases, international organisations were founded to ensure third-party verification, as in the case of the OPCW, IAEA and CTBTO. A relatively new idea is to engage civil society and use the invisible college of scholars and activists for societal verification. However, the restrictions civil society faces in some countries significantly limit their utility. Lastly, in some cases, states have decided to dispense with verification altogether, e.g. in the area of biological weapons `[/lu-03]`, because the effort would be entirely disproportionate to the result. It would simply not be possible to control all state and private facilities where biological weapons could be produced.

Examples of verification mechanisms

On-site inspections

On-site inspections may include regularly scheduled routine inspections to verify compliance with treaty terms or unscheduled challenge inspections initiated upon suspicion of non-compliance. Baseline inspections establish a benchmark inventory or facility condition.

Monitoring and surveillance

The use of various sensors in space, in the air, at sea and on land for monitoring and surveillance may include monitoring facilities and the movement of military assets from space with satellites, using seismic sensors to detect underground nuclear tests and radiation detectors to identify unauthorised nuclear activities or materials.

Data exchanges and notifications

Declarations provide detailed inventories of weapons, facilities and delivery systems, while advance notifications supply information about missile tests, troop movements or military exercises. Moreover, annual compliance reports can include regular updates on compliance and changes to military inventories.

Remote monitoring systems
Cameras and video surveillance can provide continuous video feeds from key facilities. This may be combined with environmental sampling, which involves analysing air, water or soil for traces of prohibited activities. The International Atomic Energy Organization (IAEO), for example, uses cameras to monitor nuclear facilities around the globe.

Destruction and dismantling verification
Destruction and dismantling verification may include observing the physical dismantling of weapons or facilities, maintaining and verifying documentation of destroyed systems and ensuring that dismantled components cannot be repurposed.

Implementation

Agreements on arms control measures are one thing, but implementing them is quite another. While the implementation of bilateral arms control is monitored and verified by opponents, the monitoring and verification of multilateral agreements often requires more complex institutional structures. Review conferences and conferences of states parties provide such a structure by discussing implementation on a regular basis. Their main function is to periodically focus public and diplomatic attention on the operation of a particular arms control regime.

However, such conferences also hold the potential for conflict when poor implementation is criticised and the continued existence of the regime is called into question. Since 1975, the NPT Review Conferences have been the venue for growing criticism levelled by the non-nuclear weapon states at the nuclear weapon states for not fulfilling their disarmament obligation under Article 6 of the NPT. Growing frustration with the lack of implementation ultimately led to the adoption of the TPNW by the UN General Assembly. NPT Review Conferences are a good example of how formal review conferences can become stuck in established patterns and lose their ability to generate solutions to implementation problems. As long as states continue to be interested in cooperation, however, review conferences and conferences of state parties can stabilise the implementation of arms control agreements.

1. Krass, Allan S. 1985. "Verification and Trust in Arms Control", in: Journal of Peace Research 22 (4): 285–88.

5. The future of arms control

Having discussed the different forms of arms control and the factors for its success, let us now take a look at the future of the arms control regime. Will there eventually be another golden age of arms control like the one we saw after the Cold War? Or are we destined to live in a world characterised by geopolitical competition and arms racing for decades to come?

As a general rule, arms control needs to be tailored to the state of international relations. When two nations are in conflict or are adversaries, the objectives and mechanisms of arms control may be significantly constrained, focusing primarily on curbing the risk of inadvertent conflict. The scope of arms control then increases with improving relations. Harald Müller, former head of the Peace Research Institute Frankfurt, developed the following model, which shows which arms control measures (understood in a very broad sense) are possible at which level of state relations.

Level of conflict/ Degree of relations	Goal(s) of arms control	Means of arms control
Acute hostility	Ending acts of war Stabilising relationships	Increased communication between parties Mediation by third parties
Chronic hostility	Crisis stability Avoidance of preemptive pressures [situation during the Cold War]	Increased communication between parties Increased transparency
Mixed relationships	Stabilising relationships Crisis prevention [situation in Europe 1988–1992]	Confidence-building measures (CBMs) Quantitative and qualitative arms limitations Reduction of offensive capabilities
Predominantly cooperative relationships	Preventing residual mistrust from dominating relations [Europe after 1992]	More quantitative and qualitative arms limitations Enhanced transparency
Security community	Far-reaching military integration Purely national warfare no longer possible [Europe today?]	Joint defence planning Development of multinational forces

Table based on: Müller, Harald. 1996. "Von Der Feindschaft Zur Sicherheitsgemeinschaft – Eine Neue Konzeption Der Rüstungskontrolle", in: Meyer, Berthold (ed.), Eine Welt Oder Chaos?, Friedensanalysen 25. Frankfurt am Main: Suhrkamp, 405–408, our translation.

One conclusion that can be drawn from the considerations underlying this table is that arms control must be adapted to the respective relationships in order to avoid the risk of failure from the outset. Overburdening arms control with expectations that it simply cannot fulfil at a given point in time does the concept a disservice and supports those who consider arms control to be nonsensical.

On the other hand, this model enables us to provide a tentative forecast, even though the future is of course always difficult to predict. The future of arms control will, in all likelihood, depend on whether or not some sort of political accomodation can be achieved between the great powers – Russia, China and the United States. When relations between states improve, military competition ceases to serve any meaningful political purpose – making comprehensive arms control agreements possible.[1]

One open question regarding the future of nuclear arms control remains whether the negotiation of nuclear arms control agreements between the United States and the Soviet Union in a bipolar international system during the Cold War can be adapted to the current multipolar international system, where China is likely to emerge as a third major nuclear power due to its unconstrained nuclear build-up. In principle, however, multilateral arms control should be possible and history gives us cause for optimism here. The Washington Naval Treaty concluded in 1922, for example, limited the warships of five major military powers – the United States, the British Empire, France, Italy and Japan – according to a negotiated ratio. The caveat is that all these states were allies, not enemies, during World War I.

Until political accommodation between today's major nuclear powers can be achieved, nuclear arms control will probably be conducted informally, without relying on legal treaties, without aggregate limits on weapons and perhaps even without formal negotiations between the competing parties. Existing multilateral arms control treaties, in particular the Nuclear Non-Proliferation Treaty, the Biological Weapons Convention and the Chemical Weapons Convention, on the other hand, may well be more resilient to the new security environment due to almost universal global participation. Yet, even these arms control regimes might be held hostage by their most powerful members in pursuit of their own interests.

Lastly, humanitarian arms control generally follows a different logic than traditional arms control and is thus less likely to be as severely affected by geopolitical competition. Some of the states facing high-intensity military conflict due to a direct border with revisionary and aggressive military powers may consider leaving humanitarian arms control agreements such as the Convention on Cluster Munitions or the Mine Ban Treaty, but participation should remain relatively stable in the grand scheme of things.

1. Trachtenberg, Marc. 1991. "The Past and Future of Arms Control", in: Daedalus 120 (1): 203–16.

6. Further reading

Acheson, Ray. 2023. *"Abolition, Not Arms Control: Against Reinforcing Nuclear Weapons through 'Reform'"*, in: Zeitschrift Für Friedens- Und Konfliktforschung 12 (2), 1 October: 235–43, [https://doi.org/10.1007/s42597-022-00080-w].

Brooks, Linton F. 2020. *"The End of Arms Control?"*, in: Daedalus 149 (2), 1 April: 84–100, [https://doi.org/10.1162/daed_a_01791].

Bull, Hedley. 1961. *The Control of the Arms Race: Disarmament and Arms Control in the Missile Age*. Praeger for the Institute for Strategic Studies.

Craig, Campbell / Ruzicka, Jan. 2013. *"The Nonproliferation Complex"*, in: Ethics & International Affairs 27 (3): 329–48, [https://doi.org/10.1017/S0892679413000257].

Crawford, Timothy W. / Vu, Khang X. 2021. *"Arms Control as Wedge Strategy: How Arms Limitation Deals Divide Alliances"*, in: International Security 46 (2), 25 October: 91–129, [https://doi.org/10.1162/isec_a_00420].

Egeland, Kjølv. 2020. *"Who Stole Disarmament? History and Nostalgia in Nuclear Abolition Discourse"*, in: International Affairs 96 (5), 1 September: 1387–403, [https://doi.org/10.1093/ia/iiaa096].

Gallagher, Nancy W. 2015. *"Re-Thinking the Unthinkable: Arms Control in the Twenty-First Century"*, in: The Nonproliferation Review 22 (3–4), 2 October: 469–98, [https://doi.org/10.1080/10736700.2016.1149279].

Gavin, Francis J. 2012. *"Politics, History and the Ivory Tower-Policy Gap in the Nuclear Proliferation Debate"*, in: Journal of Strategic Studies 35 (4), 1 August: 573–600, [https://doi.org/10.1080/01402390.2012.715736].

Gottemoeller, Rose. 2020. *"Rethinking Nuclear Arms Control"*, in: The Washington Quarterly 43 (3), 2 July: 139–59, [https://doi.org/10.1080/0163660X.2020.1813382].

Gray, Colin S. 1992. *House of Cards: Why Arms Control Must Fail*. Ithaca: Cornell University Press.

Jervis, Robert. 1993. *"Arms Control, Stability, and Causes of War"*, in: Political Science Quarterly 108 (2): 239–53, [https://doi.org/10.2307/2152010].

———. 2022. *"The Many Faces of SALT"*, in: Journal of Cold War Studies 24 (4): 198–214, [https://doi.org/10.1162/jcws_a_01105].

Kreps, Sarah E. / Saunders, Elizabeth N. / Schultz, Kenneth A. 2018. *"The Ratification Premium: Hawks, Doves, and Arms Control"*, in: World Politics 70 (4): 479–514.

Larsen, Jeffrey Arthur / Wirtz, James J. (eds). 2009. *Arms Control and Cooperative Security*. Boulder/London: Lynne Rienner Publishers.

Reppy, Judith / Kelleher, Catherine M. 2011. *Getting to Zero: The Path to Nuclear Disarmament*. Redwood City: Stanford University Press, [http://ebookcentral.proquest.com/lib/senc/detail.action?docID=744857].

Rogers, Jessica / Korda, Matt / Kristensen, Hans M. 2022. *"The Long View: Strategic Arms Control after the New START Treaty"*, in: Bulletin of the Atomic Scientists 78 (6), 2 November: 347–68, [https://doi.org/10.1080/00963402.2022.2133287].

Schelling, Thomas C. 1985. *"What Went Wrong with Arms Control?"*, in: Foreign Affairs 64 (2): 219.

Tannenwald, Nina. 2020. *"Life beyond Arms Control: Moving toward a Global Regime of Nuclear Restraint & Responsibility"*, in: Daedalus 149 (2), 1 April: 205–21, [https://doi.org/10.1162/daed_a_01798].

Trachtenberg, Marc. 1991. *History and Strategy*. Princeton University Press, [https://doi.org/10.2307/j.ctv14163z4].

———. 2022. *"The United States and Strategic Arms Limitation during the Nixon-Kissinger Period: Building a Stable International System?"*, in: Journal of Cold War Studies 24 (4): 157–97, [https://doi.org/10.1162/jcws_a_01104].

Terms

Confidence- and Security Building Measures (CSBMs)
Arrangements to increase trust between countries by introducing transparency and predictability regarding operations of the armed forces and other measures to demonstrate the lack of aggressive intentions