International Control of Delivery Systems: Towards a Ballistic Missile Ban

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Many countries have agreed to eliminate biological and chemical weapons in the Biological Weapons Convention (BWC) and the Chemical Weapons Convention (CWC), pledged in the Non-Proliferation Treaty (NPT) to forgo or eliminate nuclear weapons and have agreed in the Treaty on the Prohibition of Nuclear Weapons (TPNW) to establish a legal framework to ban nuclear weapons. There is yet no multinational treaty restricting the development and use of delivery systems for weapons of mass destruction (WMD). Although the NPT preamble emphasizes "the elimination from national arsenals of nuclear weapons and the means of their delivery pursuant to a Treaty on general and complete disarmament under strict and effective international control," the NPT does not further specify how this ultimate goal could be achieved for delivery systems. Compared to deterrence and defense, missile disarmament received only little attention.

The proliferation of delivery systems is one of the critically important issues related to the overall nuclear non-proliferation and arms control agenda. Delivery systems are an important part of WMD, in particular, nuclear weapons. Appropriate means of delivery are required to transport a nuclear weapon from its storage or deployment area to its target in a "militarily useful" way. Sophisticated delivery systems are costly and difficult to produce, and in many cases are the most visible parts of a nuclear weapon. Therefore, the control of nuclear-capable delivery systems would be an important step toward making nuclear weapons useless and reducing the threat of their use. This is especially true for ballistic missiles, which represent effective and powerful means to deploy nuclear weapons.

International control of delivery systems

When after the Cold War the huge nuclear and missile arsenals became obsolete, this offered an opportunity for effective missile controls. To reduce the missile threat and prevent destabilizing military reactions to missile proliferation such as ballistic missile defense, a pathway towards a NWFW would be combined with measures to control nuclear-capable delivery systems. Restricting the means for delivery of WMD is essential to reduce the threat by such weapons.

Effective control is complicated by the fact that a variety of delivery systems could potentially be used. This includes rather sophisticated delivery systems like ballistic missiles, airplanes, cruise missiles, drones and artillery, as well as a wide range of "low-technology" delivery systems – such as civilian cars, aircraft, ships or even suitcases – which can transport nuclear or other payloads. While control in the first category could effectively restrict the military value of WMD, control in the second category would have only a minor effect compared to the enormous efforts necessary. Therefore, it is reasonable to focus control on delivery systems which are explicitly designed for their military purpose and to deal with the residual risk of low-tech means of delivery by other measures.

In the first category of specially designed delivery systems, experts emphasize the priority for control of the various delivery systems differently. Most attention has been focused so far on ballistic missiles, but for some observers the military effectiveness of ballistic missiles has been exaggerated compared to aircraft. According to a 1991 study of the Center for International Security

and Arms Control, "modern aircraft are, indeed, very capable and cost-effective alternatives for ground-missions." Compared to ballistic missiles, combat aircraft with equivalent capabilities are widely distributed across the globe. There are only a few hundred ballistic missiles with ranges beyond 300 km in the hands of developing countries, compared to many thousand military aircraft beyond this range. A growing number of countries have indigenous design and production capabilities, and a range of first-rate aircraft are for sale in the international marketplace.

Although the proliferation of land-attack cruise missiles is still at an early stage, cruise missiles potentially pose a proliferation threat comparable to that of ballistic missiles and attack aircraft, and are deserving more non-proliferation efforts. Cruise missiles and drones could be easier to build than advanced attack aircraft or ballistic missiles, do not require highly trained pilots nor do they place pilots at risk, could be less vulnerable than airplanes to preemptive or suppressive attacks, and are potentially very inexpensive compared to both ballistic missiles and attack aircraft. Using Global Positioning Satellite (GPS) guidance information or remote control, cruise missiles and drones are potentially highly accurate (down to a few meters) and could be more destructive as conventional weapons – against valuable targets such as the World Trade Center or nuclear power plants – than inaccurate ballistic missiles with some WMD capability.

Compared to other nuclear capable delivery platforms, submarines can operate covertly, so that it is very difficult to monitor their location continuously. Due to their long range (more than 10,000 miles), difficult detectability and ability to operate submerged for extended periods, submarines can potentially launch strategic or tactical nuclear weapons from close to the territory of an adversary. While major nuclear weapon states have deployed nuclear powered submarines, it is possible that modern conventional-powered submarines could spread and play a role in future military conflicts.

In light of the variety of potential delivery systems for WMD, the present control regime is insufficient. The dominant approaches are export control by the major suppliers of delivery systems and bilateral arms control and disarmament of the former superpowers. The INF Treaty of 1987 removed land-based intermediate-range nuclear forces of the U.S. and Russia (including Cruise Missiles) with a 500-5,500 km range (was abandoned first by the US under the Trump Administration, then by Russia in early 2020). The Strategic Arms Reduction Treaties (START I and II) included a limitation of intercontinental ballistic missiles (ICBMs) and bombers to 1,600 and a reduction of strategic warheads to 3,000-3,500. The Moscow Treaty (Strategic Offensive Reductions Treaty) of 2002 and the New START Treaty of 2010 aimed to reduce strategic warheads and missiles launchers. The latter was extended in early 2021 while the future of nuclear arms control between US and Russia remains uncertain.

The current approach to curbing missile proliferation is the Missile Technology Control Regime (MTCR), which was initiated in 1987 and membership has grown from seven to 35 member countries, largely suppliers of missile technology. Although the MTCR has been successful in creating an international norm against missile exports and has delayed some missile programs, more significant accomplishments are impeded by problems and shortcomings. The MTCR is not a binding treaty and has no specific verification or enforcement mechanisms. Existing ballistic missile arsenals are not addressed, the asymmetry between "haves" and "have nots" is ignored, and various shorter-range missiles have been deployed in a number of developing countries. Strict export controls for dual-use goods undermine the civilian technology cooperation and economic interests

in civilian space flight.

Because of these major deficiencies, supply-side controls need to be complemented or replaced by more cooperative, demand-side solutions that go beyond the MTCR. The most effective strategy against proliferation is to strengthen the international norm against WMD by convincing all states, without exception, to forgo the option of having WMD and related delivery systems. Appropriate measures include not only barriers such as export controls but global and regional disarmament, arms control and conflict resolution, security incentives as well as international economic and technology cooperation in exchange for giving up WMD.

Regional approaches for arms control could include confidence-building measures (CBMs) as launch notification and exchanges of information, including establishment of data centers; conversion programs; common seminars on arms control; regional flight test bans; a freeze on research and development of missile technologies for military purposes. The importance of regional approaches to disarmament and confidence-building was demonstrated in South America (Argentina and Brazil) and South Asia (India and Pakistan).

Since the different types of delivery systems are closely interrelated, it is insufficient to restrict control only to one means of delivery. As has been outlined in the 1995 INESAP Study "Beyond the NPT: A Nuclear Weapon Free World", an integrated approach is necessary that goes beyond the present regime. According to this study, a number of possible measures for limiting systems that could be used for nuclear delivery, could complement and facilitate the elimination of nuclear weapons (for control of ballistic missiles see following section):

- Cruise missile non-proliferation efforts, such as the MTCR, should be continued and expanded. However, it may be necessary to adopt arms control approaches that deal with the similarities between attack aircraft and cruise missiles, and between their underlying technology bases. Verification is difficult but not an insurmountable problem, as the INF Treaty proved.
- To prevent military aircraft proliferation, states could include limits on the numbers and capabilities of military aircraft in their regional arms control regimes. A global ban on new types of combat aircraft would prevent both vertical and horizontal proliferation in a non-discriminatory way but due to the heavy involvement of such aircraft in conventional warfare all over the world such an attempt is currently questionable.
- To address the possibility that nuclear weapons could be deployed much more widely on submarines, a first step would be the creation of an international control regime, similar to the MTCR, focusing on technologies critical for advanced submarines. Joint naval task groups operated by the UN could monitor, and if necessary, control the operation of certain submarines during crises.
- Diplomatic initiatives are required to reduce the role of delivery systems in critical regions (Northeast Asia, South Asia, Middle East) and to develop international norms.

Building an international norm against ballistic missiles

The most immediate candidate for control of delivery systems are ballistic missiles, which are perceived as especially threatening and provoke the development of ballistic missile defense systems. Facing technical difficulties and lengthy development periods for advanced ballistic missiles and missile defenses, there is a chance for political initiatives to contain the emerging missile race. A global missile threat from states such as

North Korea or Iran does not yet exist. The United States or other countries don't yet have a comprehensive working missile defense system. In both cases the window of opportunity may be closing soon. Instead of relying on a non-existent missile shield against a non-existent missile threat, the international community would be better advised to act jointly and collaborate on preventing a missile race on earth and in outer space, and promoting the disarmament of nuclear weapons and delivery systems.

As the dangers of an offense-defense missile race become imminent, the need for actions to reduce the role of ballistic missiles and to control them becomes urgent, leading to initiatives for developing an international norm against ballistic missiles:

- There is need to strengthen the MTCR by developing and enhancing CBMs among states with missile capabilities. During the 1999 MTCR Plenary, the missile suppliers discussed voluntary commitments to "responsible missile behavior". At the conference in The Hague in November 2002, states agreed on an *International Code of Conduct (ICoC) Against Missile Proliferation*, including a set of principles, commitments, CBMs and incentives to contain and delegitimize missile proliferation. The *Hague Code of Conduct* (HCoC) comprises general principles, moderate obligations and limited CBMs such as annual statements on missile policy and notification of missile and space launchers. The possession of missiles is not prohibited and the intended reduction of national missile arsenals remained vague which raised the concern that the main purpose was to stop proliferation but not question the existing missile arsenals that would discriminate newcomers.
- In 1999, US and Russia agreed on a joint early warning center, and in the following year established the *Joint Data Exchange Centre* (JDEC) in Moscow to facilitate transparency and data exchange about launches of ballistic missiles with more than 500 km range, including those from other countries. Signed on December 16, 2000, the US-Russian Memorandum of Understanding on Notification of Missile Launches provides for pre- and post-launch notification of all ballistic missile tests and space launches, as well as notification of failed satellite launches. Other countries can join the agreement.
- A Russian proposal for a Global Control System on the non-proliferation of missiles and missile technology was launched in 1999 and further explored at expert level meetings in Moscow in the following years, acknowledging the security concerns of missile programs and the need for security assurances. A Global Monitoring System would increase transparency with regard to missile launches and reduce the risk of miscalculation or misunderstanding and assistance in the peaceful uses of space for states that completely give up and convert their missile programs and capabilities. It included controls on missile and missile technology transfers to third countries and prior notification of test launches of ballistic missiles and space launch vehicles. Despite the participation of 71 countries, including North Korea, the initiative did not lead to concrete results in face of opposition from the U.S. government who saw GCS as a vehicle against the missile defense plans.
- In 2000, the UN First Committee adopted a resolution on missiles introduced by Iran which emphasized the "need for a comprehensive approach towards missiles, in a balanced and non-discriminatory manner, as a contribution to international peace and security." It requested the Secretary-General, with the assistance of a panel

of governmental experts, to prepare a report on missiles in all its aspects. After three meetings of the UN Panel of Governmental Experts (UNPGE) on Missiles the final report in 2002 summarized basic aspects of missile development and control (including a definition of missiles), but large divergences prevented a recommendations. The report emphasized the large diversity of missiles and then estimated the total number of missiles worldwide as 120,000. In September 2002, a second working group was established which did not find a consensus document.

All these initiatives fell short of the initial promises and expectations. Conflicting interests of the missile powers and, in particular, the lack of interest of the US administration in multilateral arms control watered down the original intentions and did not restrain missile programs. The link between ballistic missiles and space launchers was recognized as a problem. In none of the initiatives was the disarmament or elimination of ballistic missiles seriously considered.

While progress among governments remains slow, it is important to think ahead towards a more comprehensive international missile control regime that takes into account the various stages of missile development, and the asymmetries among missile owners. As missile development advances, the potential threat increases. Once a missile has been tested, bans on deployment will be more difficult. As rapid breakout from an agreement remains possible, this will require stricter controls. Strengthening international ballistic missile controls will be a long-term process necessarily involving the adoption and evolution of a wide range of measures, from comparatively modest measures (such as a Code of Conduct, bolstered export controls, and missile monitoring and launch-notification agreements) to far-reaching disarmament treaties establishing global missile disarmament. Intermediate options would include restrictions on missile testing and the creation of missile-free zones. Candidates for such areas would be Latin America and Africa, which have established nuclear-weapon-free zones.

A missile non-proliferation regime, allowing missile owners to keep their arsenals, would have limited efficiency compared to non-discriminatory missile disarmament. The only way to deal with asymmetries between countries would be to set up an international norm against ballistic missiles that entitles all countries to equal rights. To build momentum for a comprehensive alternative, a step-by-step approach is appropriate which keeps the long-term goal in mind. Initial steps could be risk-reduction and confidence-building measures, such as de-alerting, improved ballistic missile early warning and launch notification.

Test restrictions would effectively prevent new missile designs and limit modification of traditional technology, although unsophisticated indigenous missile systems could still be developed and deployed with minimal testing. A ballistic missile flight-test ban would preclude the testing of new missiles and reduce the chance of accidental or intentional war. In order to prevent a missile race and buy more time for political initiatives, it would be helpful to institute a moratorium on the further development, testing and deployment of ballistic missiles. To address concerns about asymmetries and discrimination, a "missile freeze" could cover offensive and defensive missiles and be designed as a temporary measure while countries negotiate disarmament steps for missiles and other delivery systems. Simultaneous regional security initiatives would be crucial to diminish incentives for missile development.

When planning next steps, long-term perspectives should be taken into account, such as a ballistic missile ban that would effectively remove this threat.

Expanding the proposal discussed between Ronald Reagan and Mikhail Gorbachev at the 1986 Reykjavik Summit, in 1992 the Federation of American Scientists (FAS) presented a model for the elimination of ballistic missiles: Zero Ballistic Missiles (ZBM). Such a regime would aim at the complete elimination of offensive ballistic missiles and combine unilateral declarations with regional and global multilateral agreements. The ZBM proposal—which the FAS backed up with a complete draft treaty—combined a comprehensive framework with a stepwise approach, including bilateral cuts between the USA and Russia, ballistic-missile-free zones, an international Missile Conference, the creation of an International Agency for Ballistic Missile Disarmament and, finally, agreement on the varying schedules necessary to reach zero ballistic missile capability.

A control regime on ballistic missiles and space weapons could be also extended to the international control of ballistic missile defenses, reversing the abrogation of the Bush administration from the ABM Treaty in 2002. The terms of a new treaty could be made more precise and verifiable and/or be internationalized. Such limits would relate to the altitude, relative distance and velocity of interceptor tests, and to limits on laser brightness or to the aperture of sensors and mirrors.

Monitoring and verification

A crucial aspect in the international control and disarmament of delivery systems is verification. To exemplify the possibilities and problems, the case of verifying ballistic missile disarmament is used. The monitoring and surveillance of missile and space-related activities and the exchange of technical data would support an effective missile-control verification system. A variety of technical and non-technical means of verification exist to monitor ballistic missiles and their elimination. Remote sensing in the visible, infra-red or radar spectra, based on satellites, aircraft or on the ground, allows observation of missiles and related launch and test facilities. Some of the verification tasks can be performed by commercial satellites, which are becoming increasingly cheap and efficient.

Reconnaissance overflights, e.g. under the Open Skies regime (abandoned by US President Donald Trump in 2020) provide an alternative to satellite monitoring for many countries and can even supply superior information. During testing and training, a rocket communicates with its operators by sending and receiving telemetry signals which can be intercepted by receivers on ground stations, vehicles and satellites. Telemetry provides the necessary information on missile characteristics but is only accessible to others if non-encrypted.

To ensure adequate verification of ballistic missile elimination regimes, technical means of verification need to be accompanied by inspections. As the experiences of the UN Special Commission (UNSCOM) inspections in Iraq have shown, a regime of unimpeded fast access to suspect sites is required to detect evidence of non-compliance. Verification problems are much easier to solve when states cooperate and are willing to exchange information. Systematic inspections of all ballistic-missile-related sites can provide basic information on an initial balance. Random short-notice inspections of declared sites should be augmented by a system of challenge inspections to undeclared sites. Pre-launch inspections would ensure that no undesired payload is used.

National or international technical means of verification could focus on observable rocket characteristics (number, size, range, payload, deployment mode, launch preparations, flight trajectory), which provide indications of rocket type and performance. Much of the missile-program infrastructure – such as production facilities, test ranges, tracking and communication

facilities, missile containers and missile-carrying vehicles - is visible. The biggest complication might be the dual-use of ballistic missiles and space launch vehicles (SLVs). Differentiating between both rocket types is difficult, since much of the technology is easily convertible. However, some functional differences and operational characteristics could be used to improve distinction, such as differences in the basing mode, the testing procedures, the payload, flight trajectory, guidance systems and re-entry.

The case for a regime to control and monitor space launchers is greatly strengthened when considered in the context of preventing an arms race in outer space. Since man-made objects in orbit would enter space through space rockets, a monitoring system at space launch facilities could not only search for indications of ballistic missile use, but also for the space-weapon usability of the payload. This would provide increased transparency concerning space activities in general, and would effectively exclude the deployment and testing of space weapons using ground-based space launchers. An international control body could be set up to verify that space technology is not used for the development and production of ballistic missiles

To determine the basic payload type – in particular, to detect re-entry vehicles at the front of a rocket - without disclosing proprietary information, non-intrusive devices and techniques can be applied, such as scanning and radiographic devices. Ground-based equipment for different regions of the radiation spectrum could be mutually complementary: nuclear radiation detection could search for alpha, beta and gamma radiation, indicating nuclear materials. Neutron detection would exhibit information about the types of materials used, in particular whether they include explosives. X-ray equipment could provide basic design information while preventing violation of commercial interests. In case of suspicion, more precise x-ray detection, computer tomography or – in exceptional cases – the opening of the payload in the presence of inspectors could remove uncertainties about non-compliance.

Under a comprehensive space-launch notification agreement and missile flight test ban, any non-controlled space launch would be prohibited, and the detection of any rockets outside of agreed launch pads would indicate a violation. To limit the risk of undetected activities, it would be particularly important to implement measures that prevent the transformation of space launch technology for ballistic missiles. A safeguards system for space launchers could place some of the "most critical" items under supervision by an international organization. International cooperation in civilian space programs would also be important for containing the use of space technology for missile development.

Citizens and non-governmental organizations can play an important role in promoting, implementing and verifying missile control and disarmament. Societal verification is essential to increase the risk of detection for those who secretly build a missile capability. In order to increase public awareness, a greater public discourse on the missile problem and its resolution is required. By building a network of information exchange and debate, experts, civil society and officials could be jointly engaged in this process. Activities could include meetings and conferences involving scientists and technicians, as well as protests at, and attempts to conduct citizen inspections of, critical facilities.

Note: This article comprises some of the work of the author, based on earlier publications.

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