



Opening HCoC to cruise missiles:

A proposal to overcome political hurdles

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The Hague Code of Conduct

The issue of extending the scope of the Hague Code of Conduct to cruise missiles is regularly raised in academic and political discussions about the Code. Some non-subscribing States justify their refusal to join the instrument because of this exclusion, perceived as a major flaw. Indeed, cruise missiles have characteristics that can make them very effective in carrying weapons of mass destruction. It is therefore clearly of interest to consider extending the HCoC scope to these weapons.

Nevertheless, cruise missiles are also used as conventional missiles. It is unthinkable for States acquiring and using cruise missiles in theatres of operation to adopt confidence-building measures such as test notifications. Specifying and limiting the type of cruise missiles to be considered would thus be necessary. In view of the technological characteristics of current systems, only a functional criterion based on political declarations would be appropriate. States would be invited to pre-notify and declare "systems used to deliver weapons of mass destruction", on the basis of good faith. This standard would have limitations and could be criticized for lacking ambition and neglecting potentially proliferating systems. Nevertheless, as the current positions of subscribing States range from a lack of interest to clear hostility, a partial introduction of cruise missiles in the Code seems to be the only option acceptable at the political and strategic level.

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Introduction

In the traditionally consensual debates at the annual conference of States signatories of the Hague Code of Conduct (HCoC), the German declaration in 2018 was noticed due to its open criticism of the implementation of the Code and its call for an extension of its scope:

*"Another serious shortcoming of the HCoC is the failure to include cruise missiles, which equal ballistic missiles in their capability to deliver WMD payloads. With the development of hypersonic cruise missiles, these means of delivery may just as well constitute a destabilizing, military threat."*¹

This criticism, rare among Code members, is often heard by non-subscribing States as well as by several ballistic proliferation experts, and deserves further consideration.

The Hague Code of Conduct is to this day the only universal instrument to regulate ballistic missile programmes. Subscribing States are required to exercise restraint in their development of ballistic systems, to be vigilant in the dissemination of space and ballistic technologies and to comply with transparency measures. In particular, Member States must pre-notify missile test launches and space rocket launches. This instrument complements the MTCR, a control regime that currently has 34 members that are committed to restrict their exports of missile and space system technologies.

Signed in 2002, the Code is the result of the a momentum in favour of arms control and multilateral non-proliferation initiatives. It follows the adoption of major texts aimed at prohibiting or regulating weapons of mass destruction (WMD), such as the Chemical Weapons Convention (1993), the Comprehensive Nuclear-Test-Ban Treaty (1996), proliferation prevention measures such as the Proliferation Security Initiative (PSI), launched in 2003, and United Nations Security Council Resolution 1540 of 2004, which aims to prevent WMD transfers to non-State actors.

In this context, the Code was adopted to contribute to the prevailing efforts to counter WMD proliferation, an objective that is recalled in its introduction. The idea behind this instrument is to focus not only on the weapons themselves (nuclear, chemical, biological and bacteriological) but also on their means of delivery. For the drafters of the Code, limiting access to means of delivery was an essential step in curbing proliferation. Many proliferating States have sought to acquire ballistic capabilities to build a credible deterrent, often associated with WMD. Libya pursued a nuclear programme starting in the 1970s, with the construction of uranium enrichment facilities and the acquisition of about 80 *Scud-B* in 1976 and 40 *Frog-7*. Libya also attempted later on to import longer-range systems and to develop its own systems independently, but without success.² In Iraq too, the regime led a clandestine nuclear programme and, at the

1. Statement by Ambassador Friedrich Däuble, Permanent Representative of Germany to the United Nations Vienna and other International Organisations, HCoC Annual Conference of States Signatories,

28th to 29th May 2018, < <https://wien-io.diplo.de/iow-de/aktuelles/-/2089842>>.

2. "Libya", Countries, NTI, updated in January 2015, <<http://www.nti.org/learn/countries/libya/>>.

same time, sought the acquisition of *Scud-Bs* modified to increase their range.³

More recently, two countries have attracted attention through the development of ballistic and nuclear capabilities. In Iran, the ballistic missile programme is ongoing despite international condemnation and restrictive measures voted by the United Nations Security Council.⁴ As a result of this programme, Iran has six types of short-range missiles, five medium- and intermediate-range systems and is focusing on longer-range systems, based on technology derived from the *Simorgh* and *Safir* space launcher programmes.⁵ North Korea has reached a more advanced stage, having performed six nuclear tests since 2006 along with making significant progress in ballistic missiles. Based on earlier imports of Soviet systems, Pyongyang set up a national programme that produced several operational missiles. In addition, four ICBMs are still under development. North Korea also has an active space programme.

Given its objectives, it is therefore not surprising that the Hague Code of Conduct focused on ballistic weapons. This is all the more logical as the spread of these weapons was a real issue at the beginning of the 21st century (proliferation of Soviet *Scud-B* in Syria, Egypt, Iran, Yemen, Libya).⁶

Moreover, for a proliferating State lacking a broad industrial and technological base, combining WMDs with ballistic missiles

remains simpler and less costly than building a strategic aviation or naval force.⁷

Quickly, however, cruise missiles attracted interest, including in proliferating countries. Some nations have benefited from illicit exports (China, Ukraine) and integrated them into their deterrence programmes. This interest in cruise missile systems has been heightened by advances in missile defence systems. It has triggered several calls for better control, including the integration of cruise missiles into the HCoC framework. Dennis Gormley (*Missile Contagion*) and Mark Smith (*The HCoC: Current Challenges and Future Possibilities*), experts on missile proliferation, have written regularly on this subject. The development and testing of hypersonic missiles in Russia and China also raises the question of the value of extending the scope of the Code to these categories of weapons.

What are the current prospects for extending the scope of the HCoC? Is there a diplomatic consensus in favour of such an option or do the subscribing States have reservations? Moreover, is the inclusion of cruise and hypersonic missiles in the HCoC feasible and desirable? From an operational point of view, does such a proposal make sense? This article examines the question of extending the Code from political and technical angles, and proposes a normative framework for a partial introduction of cruise missiles into the scope of the Code.

3. "Iraq", Countries, NTI, updated in July 2017, <<http://www.nti.org/learn/countries/iraq/>>.

4. Abdullah Toukan and Anthony H. Cordesman, Iran's Nuclear Missile Delivery Capability, CSIS, 24th November 2004.

5. Missiles of Iran, Missile Threat, CSIS, <<https://missilethreat.csis.org/country/iran/>>.

6. William Potter and Adam Stulberg, "The Soviet Union and the spread of ballistic missiles," *Survival*, vol. 32, n°6, 1990.

7. Stéphane Delory, "Le missile balistique : aviation stratégique du pauvre ?," *Penser les Ailes Françaises*, n°33, 2015.

Extending the scope of the Code: a low diplomatic priority

An explicit reference to ballistic missiles when the Code was drafted

Ballistic missiles viewed as the preferred delivery system for WMDs

Because of its intrinsic link to efforts to counter WMD proliferation, the HCoC was immediately associated with ballistic missiles, which at the time had been widely imported or developed independently for non-conventional purposes by countries such as North Korea, Iran, Iraq, Syria and Libya. At the time, there were no such fears with respect to cruise missiles, let alone hypersonic missiles which were still in their infancy. For example, Iran officially unveiled its *Soumar* cruise missile, which could potentially carry a nuclear weapon, only in 2015.⁸ Pakistan's *Babur* was first tested in 2005.



Iraqi Scud shot down during the Gulf War, 1992

Of course, in 2002, cruise missiles were already used to carry nuclear weapons, and in particular the AGM-86 developed by the United States to be fitted to the B-52, or the French ASMP, both deployed in 1986. However, these systems were then held by States considered to be nuclear powers by law under the Non-proliferation Treaty (NPT). They were not widely present in the potential proliferating States of the Middle East or Asia.

Ballistic missiles have traditionally been associated with proliferation programmes, due to the import of certain systems but also to the development of national production capacities. This frequent combination of programmes is explained by the greater penetration capacity of ballistic missiles, even rudimentary ones, for countries without a highly developed technological and industrial base. It is also justified by their speed of re-entry and their ability to remain on alert at a lower cost compared to other vehicles. Indeed, an analysis of countries that have developed ballistic missile forces shows that 75% of them were also interested in building nuclear or chemical arsenals. On the other hand, no country has acquired this type of weapon without seeking to appropriate ballistic technologies.⁹ The association between ballistic missiles and WMDs has therefore emerged as a major threat. This assessment is still valid since the proliferation of ballistic missiles coupled with WMDs is still considered an "increasing

8. Missile Defense Project, "Soumar," *Missile Threat*, Center for Strategic and International Studies, published 9th August 2016, most recent modification on 4th June 2018, <<https://missilethreat.csis.org/missile/soumar/>>.

9. Steve Fetter, "Ballistic Missiles and Weapons of Mass Destruction: What is the Threat? What Should be Done?," *International Security*, vol. 16, n°1, summer 1991.

regional and global security challenge” by the United Nations General Assembly.¹⁰

In addition, ballistic missiles are associated in the popular imagination with destabilising systems, sought by “rogue” States, for terror strategies. This image, derived from the experience with Iraqi *Scud* during the Gulf War, is very different from that of cruise missiles. Cruise missiles are still perceived as state-of-the-art weapons. They are generally developed and acquired by Western States for precision military operations on non-civilian targets. This perception is non entirely accurate and has been challenged.¹¹ But it is impossible to ignore that, seen from the Western countries, the threat comes mainly from the proliferation of ballistic systems, including rudimentary ones, in countries challenging the international order, particularly because of their interest in WMDs. On the other hand, seen from the developing world, cruise missiles are a threat, a sign of Western strategic superiority at the root of illegitimate interventionist policies across the whole planet. This is even more the case for hypersonic systems.

Immediate reservations about extending the scope

The initial proposals of the MTCR Member States, at the various internal meetings that led to the Code, did not address the issue of cruise missiles. The issue was raised when the negotiations were opened to the entire

international community. In particular, at the Paris meeting in 2002, States such as Egypt, Iran and South Africa remarked that limiting the Code to ballistic systems could be reductive.¹² However, negotiators noted that it would be challenging to propose a consensual definition of cruise missiles. The notion of ballistic missile, on the other hand, was already covered by an accepted international definition based on its particular trajectory.¹³ In addition, the inclusion of cruise missiles would have made it more difficult to implement transparency measures. This would have required defining a limit on the number of launches to be notified so as not to include a set of weapons unrelated to WMD proliferation. To facilitate the conclusion of negotiations and maintain a consensus, to avoid deliberations about delicate technical definitions and to encourage subsequent implementation, the restricted scope (ballistic missiles and space launchers) was therefore favoured when the Code was signed.

Aside from this argument concerning the diplomatic aspects of the negotiations, there are other reasons why some States chose to limit the Code to ballistic weapons. Cruise missiles, then and now, represent weapons used on the battlefield and are not limited to nuclear deterrence strategies. For example, the emblematic American *Tomahawk* cruise missile was used 288 times during the Gulf War in 1991, more than 150 times in Yugoslavia in 1998-

10. UNGA Resolution A/RES/71/33, The Hague Code of Conduct against Ballistic Missile Proliferation, 5th December 2016.

11. Sam Roggeveen, “The ballistic missile stigma,” *The Interpreter*, 19th August 2009.

12. Discussions with official delegations from HCoC Member States.

13. They were especially defined during the US-Soviet arms control negotiations of the Cold War.

1999,¹⁴ 802 times during the invasion of Iraq in 2003 and again recently 57 times during the bombings of Damascus and Homs on 13 April 2018.¹⁵ For France too, cruise missiles are weapons designed to be used, as shown by the firing of seven *SCALP-EGs* in Libya in March 2011. The *SCALP-EG* has also been used regularly by France and the United Kingdom against ISIS since 2015.¹⁶ In April 2018, the naval cruise missile (MdCN) was used for the first time, in strikes on Syrian chemical facilities.¹⁷

Furthermore, cruise missiles are also involved in export agreements and international cooperation, as they are considered to be conventional weapons. The best-known example is *BrahMos*. This intermediate-range cruise missile (and thus authorised under MTCR rules) has been jointly developed since 1998 by NPO Mashinostroyeniya in Russia and the DRDO in India. The United States also exports cruise missiles like the *Tomahawk* to allied countries, such as the United Kingdom. France is trying to find buyers for the MdCN, with Poland among potential customers.¹⁸

Again, it should be noted that while the world's most powerful States, particularly those with nuclear weapons, possess ballistic missiles in their arsenals, they do

not consider them as weapons to be used on the battlefield, unlike cruise missiles and other guided weapons. As a result, these States do not necessarily assess the threat posed by the two systems in the same way. On the other hand, other States in the global South could fear the consequences of vertical proliferation and the role of cruise missiles, particularly Western ones, in conventional external operations.

Existing only in prototype form at the time the Code was signed, hypersonic systems, regardless of their propulsion system, were also not considered by MTCR members. At the time, they reflected a Western technological monopoly and did not seem to represent a vector for the proliferation of WMDs in the world's most sensitive zones. This is still the case today since research on these programmes remains limited to a few countries.¹⁹

Little diplomatic pressure to extend the Code

Weak mobilisation to revise the content of the Code

The 2018 German declaration is one of the very few expressions of a desire by the

14. Ronald O'Rourke, "Cruise Missile Inventories and NATO Attacks on Yugoslavia," *Congressional Research Service, Report for Congress*, 20th April 1999.

15. Jenny Gathright, "PHOTOS: 2 Syrian Chemical Weapons Sites Before And After Missile Strikes," *NPR*, 14th April 2018.

16. Emmanuel Huberdeau, "SCALP : Arme de choix pour Chammal," *Air & Cosmos*, 29th May 2017.

17. Nathalie Guibert, "Le missile de croisière naval,

nouvelle arme stratégique pour le chef de l'Etat français," *Le Monde*, 14th April 2018.

18. Vincent Groizeleau, "La France propose à la Pologne des Scorpène dotés de missiles de croisière," *Mer et Marine*, 3rd September 2014.

19. Programmes developed in the United States, Russia, China, with very limited R&D activities in France, Japan, Australia, India and others. See Richard H. Speier et al., "Hypersonic Missile Nonproliferation Hindering the Spread of a New Class of Weapons", RAND Corporation, 2017.

subscribing States to broaden the scope of the Code. Indeed, since the signing in 2002, no Member State has actively campaigned on this issue. Similarly, no State that has held the rotating presidency of the Code has suggested revising its content.²⁰ In Vienna in 2018, this suggestion was put forward as one of the two German proposals to improve the instrument and do more to combat ballistic proliferation. The alternative proposal aims to precisely define the launchers subject to pre-notification under the Code. Consideration of this subject is perceived as important by the German authorities. The extension of the Code's scope is less of a priority, however, and was put forward as a "*trial balloon*". In view of the lack of interest of States that could have supported this initiative, and the clear opposition of some, such as the United States, the German delegation seemed willing to abandon this perspective in the short term.²¹

However, the issue was raised again publicly in November 2018. Foreign Minister Heiko Maas listed four priorities on arms control and disarmament pursued by his government in a column in *Der Spiegel*. Among those, he announced that Germany would "*make proposals for a comprehensive regime of transparency for missiles and cruise missiles. [and] promote the discussion on an international set of rules that, for example, also includes cruise missiles.*"²² It will be therefore extremely interesting to see how this announcement is implemented and followed on in the near future.

Priority on improving the Code in its existing format

The first years of the HCoC did not go smoothly. Subscribing States had difficulty convincing some major ballistic and space powers to join the regime (in particular India and China). They also encountered reluctance on the part of the United States and Russia to implement their obligations, as the two countries initially refused publicize their pre-notifications of launches and preferred using their bilateral framework. In this context, therefore, it is logical that the priorities of the Member States, and in particular of the rotating Presidencies, have been to consolidate what already existed. In particular, efforts have been made to improve compliance with annual declaration and pre-notification commitments. As a result of these efforts, reporting rates have increased significantly over 15 years. Concrete initiatives, such as the introduction of a pre-filled "nil" form for States that do not have ballistic or space capabilities, or improvements for the internet platform on which States upload their declarations, have been made.

The second priority was to universalise the text with awareness-raising efforts in different regions of the world, resulting in an increase from 93 signatory States when the text was adopted to 139 in 2019. In particular, India's accession in 2016 was welcomed as strengthening the credibility of the instrument due to New Delhi's level of expertise in ballistic and space technologies.

20. Chile, Philippines, Morocco, Hungary, Costa Rica, France, Romania, Japan, South Korea, Peru, Canada, Kazakhstan, Poland, Sweden.

21. Discussions with official delegations from HCoC

Member States.

22. Heiko Maas, "Wir müssen über Abrüstung reden," *Spiegel Online*, 3rd November 2018.

Finally, recent presidencies (particularly Kazakhstan, Poland and Sweden) have made it a priority to increase the visibility of the Code and strengthen its links with other ballistic non-proliferation instruments such as the MTCR, Resolution 1540 and the United Nations system more broadly through the adoption of resolutions supporting the Code at the General Assembly every two years. In this context, modifying the spectrum of the Code was not seen as a priority by any of these countries.



HCoC Meeting chaired by Kazakhstan, 2016

An academic and political debate

An intellectual debate between experts

In fact, calls for an extension of the scope of the Code came mostly from ballistic proliferation experts. In 2006, a group of independent experts led by Hans Blix, former head of the International Atomic Energy Agency, suggested extending the Code to cruise missiles and unmanned

aerial vehicles. This group noted that these platforms were particularly advantageous for transporting chemical and biological weapons.²³

However, the best-known proponent of such a revision is undoubtedly Dennis Gormley, a former officer in the American armed forces and professor at the University of Pittsburgh. In his book *Missile Contagion*, published in 2008 and regularly cited in articles or conference presentations, he highlights the risk posed by the proliferation of cruise missiles and regrets their non-inclusion in the HCoC. For him, this omission contributes to giving them a harmless image. He sees this normative difference as being all the more regrettable since ballistic proliferation is relatively stable at the horizontal level, whereas he notes a wide dissemination of cruise missiles.²⁴ He also assesses that the WMD/conventional boundary is no longer as clear-cut as it used to be. The accuracy of some ballistic systems allows them to be considered for conventional missions while missiles like the Pakistani *Babur* have a clear nuclear function.

Other specialists follow Dennis Gormley's arguments. Weapon proliferation expert Aaron Karp notes that transparency efforts in the field of cruise missiles were sought not so much by MTCR members but by other States that joined the Code later and are concerned about Western arsenals and emerging systems such as the *BrahMos*.²⁵

23. Weapons of Terror, Freeing the World of Nuclear, Biological and Chemical Arms, The Weapons of Mass Destruction Commission, 2006, p.143.

24. Dennis Gormley, *Missile Contagion: Cruise Missile*

Proliferation and the Threat to International Security, Praeger Security International, 2008.

25. Aaron Karp, "Going Ballistic? Reversing Missile Proliferation," *Arms Control Today*, 1st June 2005.

WMD and space security specialist Ajey Lele developed scenarios for the Code's evolution in the 2022 timeframe. In his scenario where the Code is both more salient and effective, its scope has been extended to cruise missiles.²⁶ Finally, for Frank O'Donnell, testing in itself can be a source of confusion and misinterpretation and it is, therefore, necessary for any flight test notification confidence-building measure to include the broadest category of systems.²⁷

An argument used by the non-subscribing States

When the German statement revived the debate in 2018, it was noted that the restrictive nature of the HCoC explained why a number of States refused to sign it.²⁸ Indeed, States that are critical of the Code regularly raise this argument with varying degrees of sincerity. Among the States that initially wanted a larger scope for the Code, Egypt and Iran finally opted not to subscribe to it. They are among the non-subscribing countries that regularly cite this limitation as a reason for refusing to subscribe. Thus, during negotiations at the United Nations General Assembly on a

resolution in support of the Code in 2004, Egypt voted against it because of the fragmented treatment of missiles by the Code and the failure to take cruise missiles into account.²⁹ Most recently in 2016, Cuba abstained again on the draft resolution supporting the HCoC, stating that "among its many shortcomings, the Code only mentioned ballistic missiles, and not other types of missiles."³⁰ In forums on this subject, Mexico and Brazil said that they would not join the Code partly because of the lack of reference to cruise missiles. Some comments, yet to be supported by facts, have suggested that their inclusion could change the position taken to date in some of these countries.³¹ In its current state, the Code regulates the most "basic" weapon, coveted by some States in the global South and is mute on the more sophisticated weapons (cruise and hypersonic missiles), used by the Western powers. This situation remains a source of disagreement and is viewed as a bias of the instrument by a number of States.

Academic circles and non-signatory States emphasize the utility of extending the scope of the Code. However, there is no real diplomatic pressure to back this project. This is due to the opposition of the States

26. Ajey Lele, "Special Report: The Hague Code of Conduct: Predicting the Future," Society for the Study of Peace and Conflict, 15th January 2013.

27. Frank O'Donnell, "Launching an Expanded Missile Flight-Test Notification Regime," Stimson *South Asia Program*, 23rd March 2017.

28. "Germany is convinced that these shortcomings are one of the main reasons why a substantial number of States with ballistic missile programmes still hesitates to subscribe to the Code." German Statement, op. cit.

29. Hague Code of Conduct against Ballistic Missile Proliferation Welcomed in Text Approved by Disarmament Committee, First Committee, 17th Meeting, GA/DIS/3286, 26th October 2004.

30. First Committee Sends 22 Texts to General Assembly, Echoing Call for Expanding Nuclear-Weapon-Free Zones into Middle East, Bolstering Disarmament Efforts, First Committee, 22nd Meeting, GA/DIS/3563, 27th October 2016.

31. Discussions with official delegations from HCoC non-subscribing States.

possessing these weapons and the desire of the entire community of subscribing States to focus on better implementation of the Code in its current format. At the strategic and security level, the relevance of cruise missiles to the HCoC must be assessed in the light of the Code's two objectives: to ensure transparency measures between powers holding dual-capability delivery systems on the one hand, and to counter the proliferation of WMD delivery systems on the other.

Consequently, the question of the introduction of cruise missiles into the HCoC leads back to the relevance of this type of missile as a carrier of weapons of mass destruction. Cruise missiles are guided weapon delivery systems that generally fly in the lower atmosphere (less than 20 km above sea level) and use aerodynamic lift to maintain flight.³² However, as noted above, missiles are only relevant to the Code in their role as WMD delivery systems.³³ This ability to carry WMD in a proliferating context, which is obvious for ballistic missiles,³⁴ must be set forth in similar fashion for cruise missiles.

A missile must meet several conditions in order to constitute a credible vehicle for a weapon of mass destruction. By identifying the technical thresholds at which cruise missiles become relevant WMD delivery systems, based on the WMD characteristics, we can determine, among current cruise missiles and those likely to result from the dissemination of related technologies, which delivery systems could be capable of

carrying weapons of mass destruction.

This also involves estimating the real risks of cruise missile proliferation as a means of delivering weapons of mass destruction, i.e. considering the risks of the diffusion of these technologies in proliferating areas. This analysis suggests a normative basis for the inclusion of cruise missiles into the HCoC. This proposition takes into account that the vast majority of cruise missiles are intended to remain conventional weapon delivery systems, since they have been developed or acquired by States subject to non-proliferation commitments applying them in good faith.

32. Missile Technology Control Regime, Annex Handbook 2017, p.33.

33. As underlined, for example, in Article 2(a) of the Code.

34. Ajey Lele, "The Hague Code of Conduct: Predicting the Future", *Special Report*, Society for the Study of Peace and Conflict, p.1.

Focus: Main cruise missile programmes and perspectives for technology dissemination

Ever since the *Tomahawk* was used during the Gulf War, interest in cruise missile technologies, in particular for ground attack (*Land Attack Cruise Missile* or LACM), has increased considerably. Signs of dissemination of these missiles emerged in the 2000s.³⁵ The quasi-monopoly held on related technologies, in particular that of the LACM, by the United States and the USSR/Russia is being loosened.³⁶ There are several areas of widespread dissemination of cruise missile technologies: these are mainly the Middle East, South Asia and North-East Asia. However, the United States, China and Russia are the three powers that allocate the most resources to the acquisition of dual-capable precision cruise missiles.

Debris of American *Tomahawk* missiles used on the battlefield contributed early on to the proliferation of cruise missiles. This subsonic weapon, with a range exceeding 1,500 km, has been employed about 2,200 times since 1991 by U.S. forces and is also used by the British. The Americans have also made extensive use of the *JASSM* and *JASSM-ER* air-to-ground missiles in operational conditions. Both weapons have been exported to NATO allies, unlike the AGM-86 ALCM dual-capable missile,

which has never been exported.³⁷

Russia has a diverse arsenal of LACMs, at least five of which are dual-capable, but not all of which are equipped with deployed nuclear warheads.³⁸ Russia holds older models from Soviet times, such as the RK-55, deployed on Russian submarines and with a range of 2,400 km, and the Kh-55 air-to-ground weapon, which can be converted into a ground-to-ground missile, as Iran has done (see below). Ukraine exported the Kh-55 to Iran and China, allowing these two countries to develop presumably equivalent cruise missiles. In the 1990s, Russia developed the Kh-101 stealth cruise missile, with an estimated range of 2,500 km, and its nuclear version Kh-102, both powered by high-bypass turbofan engines.³⁹ During the war in Syria, Russia used its 3M14 *Kalibr* cruise missile, fired from ships and submarines in the Caspian Sea. This weapon, with a range between 1,500 and 2,500 km, has dual capability. The *Kalibr* launched against targets in Syria actually belongs to a family of cruise missiles known as *Kalibr/Club*, which can be deployed on surface ships, submarines and land platforms developed by Russia.⁴⁰ Russia has exported *Club* models complying with the MTCR, mainly in its anti-ship version, to India, Algeria, Vietnam, China and Iran. These have a maximum range of 270 km and payloads up to 450 kg.

With its *Hong Niao* (HN) series, China has acquired cruise missiles with strategic capability by reverse-engineering Soviet and

35. Dennis Gormley, "Making the Hague Code of Conduct Relevant," *HCoC Research Papers*, Fondation pour la recherche stratégique, 2009, p.4.

36. Id.

37. The ALCM (AGM-86) remains essentially a nuclear missile, few conventional anti-bunker variants (AGM-86D) having been produced. As the missile is no longer in production and the conventional ver-

sion was developed belatedly, it has never been exported.

38. National Air and Space Intelligence Center, op. cit.

39. Military Today, "Kh-101 Air Launched Cruise Missile," *militarytoday.com*, consulted on 24th July 2018.

40. Jeffrey Lewis, "Sokov on Russian Cruise Missiles," *Arms Control Wonk*, 25th August 2015.

American cruise missile technologies. HNs have payloads in the range of 400 kg, allowing them to carry nuclear warheads. The HN-2 has a range of 1,800 km and a CEP of less than 10m.⁴¹ The HN-3, which came into service in 2007, is thought to have a range of 3,000 km.⁴² China is also developing supersonic technologies. In 2014, China presented the CX-1, a tactical anti-ship or ground attack missile powered by a rocket engine and then a ramjet.⁴³ This supersonic missile could reach Mach 3 or Mach 2.4 depending on its cruise altitude. The missile has a maximum range of 280 km making it suitable for export. Other Chinese ramjet-powered cruise missiles have longer ranges, such as the YJ-12A, an air-to-surface missile with a range of 400 km.

France employs its own cruise missiles: ASMPA, reserved for nuclear deterrence, and the *Apache* family, including the *SCALP EG/Storm Shadow* with a 400 kg payload and a range of 400 km and the Naval Cruise Missile (MdCN), with a range of 1,000 km and a 300 kg payload, recently used in Syria.

The technologies held by these powers have spread through legal or illegal international transfers, but also through international cooperation and even through the recovery of debris from missiles used in operational conditions.⁴⁴ Activities related to the diffusion of cruise missile technologies are particularly

noteworthy in the Middle East, India and Pakistan.

In 2001, Iran acquired from Ukraine six to twelve Kh-55 LACMs of Russian origin with a range of 2,500 km.⁴⁵ The Kh-55 was the main air-to-ground weapon of the USSR for nuclear strike.⁴⁶ Probably using Kh-55 technology, Iran claims to have developed the LACM-type *Soumar* cruise missile, publicly unveiled in March 2015. It has a claimed range of 2,500-3,000 km. It could complement Iran's ballistic arsenal, which remains vulnerable to U.S. and Israeli missile defence systems.⁴⁷ The missile is thought to retain the Kh-55's high-bypass turbofan engine and to be equipped with a rocket engine for initial propulsion. However, there are doubts about Iran's ability to produce indigenously high-bypass turbofan engines such as those of the Kh-55.⁴⁸ Thus, the number of operational *Soumars* held by Iran is subject to speculation.⁴⁹ The *Soumar* is a ground-to-ground cruise missile, but Iran could develop versions using other launch platforms.⁵⁰

It is highly unlikely that Tehran could have foreseen the possible production of nuclear warheads that could fit on the *Soumar*. The *Soumar* has a diameter of 0.5 m and, like the Kh-55, can probably carry a payload of 400-450 kg, which excludes first-generation nuclear weapons.

41. Missile Threat, "Hong Niao," *missilethreat.csis.com*, 12th August 2016.

42. Id.

43. Henri Kenhmann, "CALT teste son missile anti-navire supersonique CX-1 pour un client d'export," *East Pendulum*, 18th July 2018.

44. Pakistan and China, for example, could have performed reverse engineering on remains of *Toma-hawks* used by the Americans in Afghanistan and recovered on the ground in Pakistan in August 1998. See *Jane's Strategic Weapons*, "Hatf 7 (Babur)."

45. Gormley, "Making the Hague Code of Conduct

Relevant," op. cit., p.5.

46. Michael Eisenstadt, "The Role of Missiles in Iran's Military Strategy," *Research Notes n°39*, The Washington Institution for Near East Policy, November 2016, p.6.

47. Missile Advocacy Alliance, "Soumar," *missileadvocacyalliance.org*.

48. Missile Threat, "Soumar," *missilethreat.csis.com*, 9th August 2016.

49. Eisenstadt, op. cit., p.3.

50. National Air and Space Intelligence Center, op. cit. p.32.

In South Asia, India and Pakistan are competing to acquire cruise missile strike capabilities. By cooperating with Russia, which supplied the design of its *Oniks* missile, India has been able to deploy the *BrahMos*, a cruise missile equipped with a ramjet allowing it to reach supersonic speeds of up to Mach 5. The *BrahMos*, with a diameter of 0.67 m, can carry a payload of 300 kg and has a range of 300-350 km, which would probably enable it to deliver a modern nuclear weapon.⁵¹ Thanks to the *BrahMos*, India master the ramjet technologies necessary to produce supersonic or even hypersonic missiles, as it aims to do with the *BrahMos-II* programme.

India is also working to develop independently a subsonic dual-capability cruise missile, called *Nirbhay*, with a range of 800-1,000 km. India is targeting a missile that can be deployed on various platforms and can follow complex trajectories.⁵² The *Nirbhay* has a diameter of 0.5 m with a payload capacity of up to 450 kg, allowing it to carry a small nuclear weapon. However, India seems to be having difficulty in designing the turbofan engine for the missile, illustrating perfectly the complexity of this type of technology, even for an industrially advanced State.⁵³

Pakistan's programmes appear to be supported by China.⁵⁴ Pakistan launched the development of *Babur* (*Hatf 7*) in the 1990s to diversify its arsenal of nuclear weapon delivery systems, citing its need to strengthen its

deterrence capability.⁵⁵ The first test was conducted in 2005, and Pakistan unveiled its new missile with a range of 500 km. Several subsequent tests saw the *Babur* reach 700 km, and Pakistan plans to deploy a missile with a range of 1,000 km on various platforms; some estimates give the *Babur* a range limited to 350 km.⁵⁶ The *Babur* remains a subsonic missile powered by a turbofan engine of Chinese or Ukrainian origin.⁵⁷ With a diameter of 0.52 m, the missile can carry a payload of 450-500 kg. According to available data, it would be combined with a 35 kT nuclear weapon.⁵⁸

Pakistan has another dual-capable air-to-ground cruise missile programme called *Ra'ad*. Described as a derivative of the *Raptor II*, a missile acquired by Pakistan from South Africa in the early 2000s, the *Ra'ad* is also equipped with a turbofan engine of Chinese or Ukrainian origin. Its payload is 400-450 kg for a diameter of 0.53 m, and sources indicate that the missile can carry a nuclear payload of 15 kT.⁵⁹

While the characteristics and number of nuclear weapons held by India and Pakistan are still not well known, it seems likely that both States are able to deliver their weapons using the cruise missile types at their disposal.

51. Military Today, "BrahMos," www.militarytoday.com, consulted on 11th July 2018.

52. Including loitering over the target, see Franz-Stefan Gady, "India Successfully Test Fires Indigenous Nuclear-Capable Cruise Missile," *The Diplomat*, 8th November 2017.

53. Id.

54. Gormley, "Making the Hague Code of Conduct

Relevant," op. cit. p.5.

55. *Jane's Strategic Weapons*, "Hatf 7 (Babur)," op. cit.

56. National Air and Space Intelligence Center, op. cit. p.37.

57. *Jane's Strategic Weapons*, "Hatf 7 (Babur)," op. cit.

58. Id.

59. *Jane's Strategic Weapons*, "Ra'ad."

Examples of cruise missiles in use or in development worldwide								
Model	Description	Origin	Entry into Service	Max. range (km)	Payload (kg)	Diameter (m)	Launch Platform	Exported/ Transferred
AGM-86B	Nuclear subsonic missile	USA	1982	2500	450-1350	0.69	Aircraft	No
BGM-109E Tomahawk	Conventional subsonic missile	USA	1983	1500	450	0.52	Submarines & Naval ships	Yes
Kh-55/Kh-555	Dual-capable subsonic missile	Russia	1984	3500	400	0.5	Aircraft	Yes
Kh-101/Kh-102	Dual-capable subsonic missile	Russia	2012	3000	450	0.51	Aircraft	Yes
3M14 (Kalibr)	Dual-capable subsonic missile	Russia	2015	2500	450	0.53	Submarines & Naval ships	No
Hong Niao 3	Subsonic cruise missile	China	2007	3000	?	0.75	Multiple	?
Scalp EG/Storm Shadow/Black Shaheen	Conventional subsonic missile	France	2002	400 (export 290)	400-500	0.63	Multiple	Yes
MdCN	Conventional subsonic missile	France	2015	1000	250-300	0.50	Submarines & Naval ships	?
Nirbhay	Dual-capable subsonic missile	India	In development	1000	450	0.52	Multiple	?
Brahmos 1	Conventional supersonic missile	Russia/India	2006	500	200-300	0.67	Multiple	Yes
Babur/Hatf 7	Dual-capable subsonic missile	Pakistan	2010	700	450	0.52	Ground launched	?
Ra'ad	Dual-capable subsonic missile	Pakistan	In development	350	450	0.53	Aircraft	?
Soumar	Conventional subsonic missile	Iran	2012 (unveiled 2015)	?	?	0.51	Ground-launched	?

The suitability of cruise missiles for the delivery of weapons of mass destruction

In order to constitute a credible delivery vehicle for weapons of mass destruction, a cruise missile must demonstrate adequate performance in terms of survivability (both before launch and during flight), range/payload ratio and possibly accuracy. Naturally, depending on the nature of the WMD under consideration, the required performance of the delivery system differs. At the same time, cruise missile models vary considerably in their characteristics and performance, depending on the missions but also on the design dates, rendering over-categorisation futile. Some systems could be in theory qualified as potential WMD delivery systems but would require such adaptations that other systems would probably be preferred; others are ineligible, while some meet all the eligibility criteria, either because they were designed to deliver WMDs or because they derive directly from such systems. It is therefore necessary to establishing technical or operational criteria, which characterize cruise missiles being considered as WMD delivery vehicles.

Operational systems potentially suitable for carrying WMDs

Pre- and post-launch survival

The survivability of a cruise missile is a decisive factor when this weapons is

considered as a credible WMD delivery vehicle. An actor planning to use of a weapon of mass destruction wants to minimise the chances of interception especially if it only uses a limited number of missiles. In the more specific context of proliferation, a missile with a high survivability potential is essential for proliferators whose nuclear arsenal is often very small.⁶⁰ Therefore, if the survivability of cruise missiles is low, they are of little interest as WMD delivery vehicles.

Many cruise missiles are subsonic, and their low velocity clearly makes them more vulnerable to interception than ballistic missiles.⁶¹ Long-range cruise missiles, powered by high-bypass turbofan engines, typically have speeds in the order of 0.2 km/s (800 km/h). It is true that ramjet propulsion systems —, which equip the French ASMPA, the Russian-Indian *BrahMos* or the Chinese CX-1, for example — also allow cruise missiles to reach supersonic speeds. This velocity reduces the ability of anti-missile defences to intercept them. However, the ramjet technology restrains the range of the missile, often to less than a thousand kilometres for air-to-ground versions and no more than a few hundred kilometres for ground-to-ground versions. In addition, ramjet technologies remain very difficult to master and are beyond the reach of many actors.⁶² It is not impossible that they may soon be offered for export and foster proliferation. Reverse engineering on this type of technological building block

60. Irving Lachow, "GPS-Guided Cruise Missiles and Weapons of Mass Destruction," in Kathleen C. Bailey, *Director's Series on Proliferation*, 1st June 1995, p.21.

61. The U.S. *Tomahawk* flies at a speed of around

0.24 km/s (880 km/h) and the French MdCN, at 0.2 km/s (800 km/h), while Pakistan's *Babur* has an estimated speed of 0.22 km/s (850 km/h).

62. Ramjet know-how is possessed primarily by the United States, Russia, France, India and China.

remains at this stage very difficult (see below). There is no comparison between the observed speeds on cruise missiles⁶³ and ballistic missiles. For example, at a range of 2,000 km, a subsonic cruise missile will take between two and three hours to reach its target, while a ballistic missile of equivalent range will take only 13 minutes. The cruise missile is, therefore, subject to a risk of interception, mitigated by various factors. Moreover, speed is not always the preferred solution. Many missiles favour stealth systems that rarely allow for supersonic solutions.

Cruise missiles do have intrinsic advantages. They present a different challenge than ballistic delivery systems for radars and missile defence systems. For a long time, the development of missile defence took place in response to the ballistic missile threat. However, cruise missiles, with a small radar cross section, easily linked to jamming systems, are difficult to detect by traditional radar architectures.⁶⁴ Similarly, the increasingly systematic use of stealth materials and shapes enhances penetrability. Finally, the missiles' trajectory is much more complex than that of a ballistic vehicle as they generally fly at a very low altitude.⁶⁵ Flying very low often allows them to escape detection from the ground. These elements increase the utility of cruise missiles both for second strikes and for surprise strikes. This

effectiveness is even clearer if the enemy's defensive capabilities have already been eroded or if both types of missiles (ballistic and cruise) are combined in the same attack.⁶⁶ Cruise missiles, therefore, are of interest not only on their own, but also as a complement to ballistic arsenals. As such, they constitute an attractive second strike vehicle.

Finally, cruise missiles are less expensive than ballistic systems and can be used for saturation attacks.⁶⁷ Missiles equipped with weapons of mass destruction, therefore, can be concealed in waves of conventional missiles, increasing their survivability. Due to their size and reduced mass compared to ballistic missiles, a greater number of missiles can be deployed on a variety of platforms. The system thus improves its chances of survival in the event of a pre-emptive strike and thus enhances its credibility as a deterrent.

Range/payload ratio

A missile does not require a long range to have a high strategic value. Short-range missiles may have a strategic function in confined geographical areas, such as the Middle East. More generally, in most parts of the world where the risk of proliferation is a concern, strategic distances are limited. India and Pakistan, the Korean peninsula

63. Gormley, "Making the Hague Code of Conduct Relevant," op. cit.

64. Renaud Chatelus, "Limiting the proliferation of WMD means of delivery: A low-profile approach to bypass diplomatic deadlocks," *HCoC Research Papers*, p.7 and Gormley, "Making the Hague Code of Conduct Relevant," op. cit., p.10.

65. In nap-of-the-earth flight, some cruise missiles can fly at an altitude of less than 10 m over flat

terrain, like the Chinese CX-1. Depending on operational requirements, altitude can be much greater. See Carlo Kopp, "Cruise missiles guidance techniques," *Defence Today*, p.55.

66. Gormley, *Missile Contagion, Cruise Missile Proliferation and the Threat to International Security*, op. cit., p.8.

67. Gormley, "Making the Hague Code of Conduct Relevant," op. cit., p.10.

and the Middle East⁶⁸ are areas where relatively short-range weapons can be considered of strategic importance. The very circumstantial nature of the notion of strategic effect matters particularly in terms of range/payload ratio, which, by international standards, is a discriminating factor in classifying a missile. The MTCR sets a ratio of 300 km/500 kg as the threshold at which a missile becomes a potential delivery vehicle for weapons of mass destruction. The introduction of high-bypass turbofan engines⁶⁹ gives cruise missiles ranges well in excess of 1,500 km. Nevertheless, technical constraints impose relatively low payloads on these systems, in the order of 250kg. Associating a chemical weapon with these systems is of questionable interest, while coupling a nuclear weapon requires a high degree of expertise in weapon miniaturisation.

Conversely, constraints differ for shorter ranges. Designing cruise missiles that are both very fast and capable of carrying a heavy payload (well over 500 kg) is possible with relatively simple liquid propulsion systems. Such a combination undoubtedly offers a real strategic capability. Many first- and second-generation Soviet anti-ship missiles had such characteristics. Any State with sufficient liquid propulsion expertise can copy these models. For systems based on solid propulsion or turboprop engines, the payload is rarely sufficient to allow the mating with first-generation nuclear weapons or chemical weapons. If the missiles are large enough, however, these technologies can be advantageous.

Quite logically, the constraints related to range, speed and payload are much less discriminating in confined theatres than in large-scale theatres. As such, the issue of propulsion technology dissemination is as relevant as the question of cruise missile dissemination *per se*.

Accuracy

Accuracy is an important factor in the utility of cruise missiles, particularly with regard to chemical and bacteriological weapons. Cruise missiles remain in the atmosphere throughout their flight. To avoid excessive drift, it is necessary to complement inertial technologies with additional devices. Guidance technologies, in particular GPS-type,⁷⁰ have been operational since the 1980s and have gradually become extremely accurate. A very large majority of States currently have the ability to develop systems precise enough to prevent excessive drifting during missile navigation, though there is a risk of hostile jamming.⁷¹



U.S. Tomahawk using the TERCOM guidance technology

TERCOM (terrain following using a radar altimeter) and DSMAC (imagery

68. Irving Lachow, "GPS-Guided Cruise Missiles and Weapons of Mass Destruction," op. cit., p.17.

69. Kopp, op. cit, p.55.

70. Lachow, op. cit., p.1.

71. Kopp, op. cit., p.56.

comparison) technologies, needed for missiles flying at low altitudes, require considerable resources to collect the data necessary for their operation. They are within the reach of major powers but more difficult to acquire for proliferating States. They are mandatory for using conventional missiles but less so if the warhead is nuclear and the vehicle flies a simple trajectory.

An attractive delivery vehicle for chemical and biological weapons

Limited effectiveness in delivering nuclear weapons

If the three criteria of survivability, range/payload ratio and accuracy are considered, the advantages of cruise missiles as a nuclear weapon delivery vehicle are far from obvious. Its low velocity may cause interception, and its accuracy does little to increase its usefulness, except for nuclear decapitation strikes that proliferating States generally do not contemplate. In these respects, ballistic missile remain preferable to carry nuclear weapons,⁷² especially since their accuracy has improved considerably.⁷³ Cruise missiles are only an attractive means of delivery if they are more survivable than ballistic systems. Cruise missiles can offer certain advantages in this respect. They are flexible and easier to hide, transport and deploy on a variety of platforms. Besides, as underlined above, their unpredictable trajectory makes them hard to intercept for traditional defence architectures.

Nonetheless, the limited payload and

diameter of cruise missiles are likely to represent serious obstacles to their ability to carry first-generation nuclear weapons. The payload of most cruise missiles deployed today does not exceed 500 kg, and their diameters are generally comprised between 0.5 and 0.6 m. Lowering the mass of a nuclear warhead to allow it to be carried by such a missile remains difficult.⁷⁴ In a proliferation context, therefore, the limited payload of cruise missiles limits their desirability as nuclear weapons carriers. This assessment might need reevaluating in the future as the missiles' payload capacity progresses and the mass of nuclear warheads diminishes, making cruise missiles increasingly attractive as means of delivery for nuclear weapons.

An effective weapon for bacteriological and chemical weapons

The same criteria can be used to assess the relevance of cruise missiles to deliver bacteriological and chemical weapons. Unlike nuclear weapons, cruise missiles can be very useful as chemical agents carriers. They are able to spread agents over specific areas. They are difficult to locate and benefit from the element of surprise more than others, equally manoeuvrable and accurate vehicles. This minimises the time available to set up passive defences.⁷⁵ In addition, their manoeuvrability in the terminal phase enables to use special tanks. On the contrary, the detonation of a ballistic missile, necessary to disseminate the agent, can destroy part of the payload⁷⁶ and restricts the effect to limited areas relative

72. Lachow, op. cit., p.21.

73. National Air and Space Intelligence Center, "Ballistic and Cruise Missile Threat," 2017.

74. Lachow, op. cit., p.16.

75. Id, p.18.

76. Id, p.19.

to the point of impact and the wind direction. This limitation means that more weapons should be used for an equivalent result.⁷⁷

The same analysis is applicable to bacteriological weapons. In this case, the penalising factor of the low payload of cruise missiles does not apply. The lethality area of biological weapons is indeed much larger than that of chemical weapons. A mass of anthrax can cover between 400 and 2,000 times the area covered by the same mass of sarin gas. More accurate, slower and following a low and manoeuvring trajectory, cruise missiles are, according to specialists, more effective as carriers of bacteriological weapons, by a factor of 1 to 10.⁷⁸ Finally, chemical and bacteriological agents are less likely to be damaged during the flight of a cruise missile than during a ballistic flight.⁷⁹

This analysis demonstrates that cruise

missiles could theoretically constitute credible delivery systems for weapons of mass destruction. This is clear for chemical and biological weapons, but also, under more restrictive conditions, for nuclear weapons. The primacy of ballistic missiles as nuclear weapon delivery vehicles "*seems to fade as the use of cruise missiles for long range delivery of nuclear weapons is becoming a credible prospect.*"⁸⁰

Technical and normative proposals for the inclusion of cruise missiles into the Hague Code of Conduct

The normative choice to exclude cruise missiles from the Code seems to imply that the development of ballistic missiles is the only form of unacceptable delivery vehicles proliferation. It appears unjustified in light of our analysis.⁸¹ In addition, the deployment of dual-capable cruise missiles

77. It should be noted that cruise missiles can only carry a limited volume of chemical agents. In 1995, Irving Lachow proposed a method for estimating the capacity of different cruise missiles to cover a given zone with chemical agents, depending on payload capacity. He concluded that "conventional" payloads were likely to be insufficient for the most probable targets for chemical weapons, such as ports, airports or extensive frontline zones. These estimates underline the fact that, in order to constitute a credible delivery platform for chemical weapons, cruise missiles must have a substantial payload capacity. In that case, unless the strike aims only at a political effect, it would require a large number of missiles to be significant in military terms. Thus, cruise missiles could become a preferred weapon due to reduced platform production costs. Ibid, p. 20.

78. Gormley, "Making the Hague Code of Conduct Relevant", op. cit. p.9.

79. *The Weapons of Mass Destruction Commission, Weapons of Terror*, Freeing the World of Nuclear, Biological and Chemical Arms, 2006, p.142.

The Office of Technology Assessment of the U.S. Congress summarised these issues as follows in 1993: "*Since biological warfare agents are, like chemical ordnance, best disseminated in an aerosol over a wide area, (...) cruise missiles are better for delivering them than ballistic missiles. In addition, it is more difficult (but not impossible) to develop ballistic missiles warheads in which biological agents can survive the stresses of space flight and atmospheric re-entry*". The members of the Weapons of Mass Destruction Commission concluded simply that: "*Cruise missiles (...) are more suitable for the delivery of biological weapons and chemical weapons than ballistic missiles.*"

80. Chatelus, op. cit., p.6.

81. The wording is that of D. Gormley, Gormley, "Making the Hague Code of Conduct Relevant," op. cit., p.4.

is likely to generate test-related instabilities. Transparency and confidence-building measures between governments in that field are therefore welcome. Since 2005, India and Pakistan have had their own pre-notification regime for ballistic missile launches. Before acquiring its first LACMs, Pakistan tried to include cruise missiles in the regime, a proposition opposed by New Delhi. After the first *Babur* tests in 2005-2006, India reviewed its position.⁸² Negotiations between the two countries have been unsuccessful so far,⁸³ as Pakistan's protests regarding the unannounced *Nirbhay* test in November 2017 conflict with the limitations of the pre-notification mechanism.⁸⁴ Nonetheless, these developments show that main stakeholders in the field strongly feel the need for transparency measures for cruise missiles also.

However, in reality, the vast majority of cruise missiles deployed and tested in recent years are weapons designed for conventional operations. In the eyes of many subscribing States, submitting all these delivery systems to HCoC measures because they are *potential* WMD delivery systems is not justified. These subscribers refuse to impose too many constraints on systems that they consider primarily weapons that can be used conventionally on the battlefield. There is a reluctance to disclose stockpiles, notify each test or consider export restrictions. Moreover, for

the vast majority of subscribing States, cruise missiles can only be conventional vehicles, as they have no industrial capacity and nor political will to design WMDs. For these reasons, major nuclear powers appears to oppose the extension of the Code. At the same time, they use conventional versions of these same types of weapons in military strikes, thus creating a problem of distinguishing between the two types of weapons and justifying their non-inclusion in a code essentially dedicated to confidence-building measures on WMD delivery systems.

Including cruise missiles into the HCoC requires distinguishing between nuclear and non-nuclear capable missiles and making the declaration of nuclear systems acceptable to States that possess them. The HCoC does not currently refer to any technical specification to classify a ballistic missile capable of carrying a WMD. With the extension of the Code's scope, it would be necessary to abandon the MTCR logic based on the technical characteristics of missiles. Conversely, it would be necessary to integrate what is relevant to the function of the missile or, alternatively, what can be deduced from its characteristics, in relation to the State that produces or acquires it. Such a logic would depend on the good faith of the signatory States. This potential limitation already characterises the implementation of this Code of Conduct, which is by definition not binding.

82. *Id.*, p.7.

83. In June 2011, for example, India and Pakistan exchanged proposals to reform the pre-notification mechanism.

See Nuclear Threat Initiative, "India Missile Chronology," *www.nti.org*, revised June 2012.

84. Mariana Babaar, "Cruise missile test: Pakistan shows concern as India fails to notify," *The News*, 17th November 2017.

Dealing with identified dual-capable cruise missiles

Notifying missiles only intended for the nuclear role

For nuclear-weapon States, some cruise missiles have a declared nuclear function as part of deterrence doctrines. This is the case, for example, for the U.S. AGM-86 ALCM, currently carried by the B-52, or the ASMPA, carried by the Rafale of the French Strategic Air Forces. With the extension of the scope of the Code, these two systems would be subject to test flight pre-notification and integration into the annual declarations of the United States and France. Many cruise missiles, however, are dual-capable systems, with nuclear and conventional versions. Under this proposal, States would have to notify only those missiles with an explicit nuclear role. For example, the American *Tomahawk* is a dual-capable missile with a range of more than 1,500 km. The A version is equipped with a nuclear warhead, while the C and subsequent versions are equipped with conventional warheads and are now considered as theatre weapons and no longer as strategic delivery systems. Only these latest versions are still produced. Visually, it is very difficult to differentiate one from the other. Washington has exported conventional version of the missile to the United Kingdom.

If the HCoC were to integrate cruise missiles, how would the *Tomahawk* case be treated? The solution is probably simpler than it seems. As the HCoC is primarily a

code of conduct, the United States would report its *Tomahawk-A* stockpile. *Tomahawk-C* and subsequent versions would not be declared by either Washington or London. One might wonder whether this type of conventional missile could actually be converted to carry nuclear weapons. The case of the *Tomahawk* is a textbook case since the United Kingdom looked into the possibility of using cruise missiles as a replacement for its current *Trident* ballistic missiles.⁸⁵ The British studies show that adapting a nuclear weapon to this type of missile would require a lengthy redefinition of the warhead, equivalent in fact to the design of a new weapon. This analysis, carried out by a long-standing nuclear power, shows that in the case of a transfer of conventional missiles to an emerging nuclear power, the question of the delivery vehicle is, therefore, secondary with regard to the question of the nuclear weapon design.

Difficulties related to dual-capable systems

The situation is more complex in the case of the 3M54 and 3M14 variants of the Russian *Kalibr*.⁸⁶

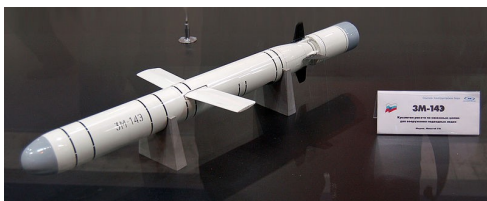
It affects both the security of Russia and that of its export partners. The two families of missiles are quite similar. The 3M14 strategic missile is dual-capable, and its range probably exceeds 1,500 km. Its conventional version is designated 3M14 NK or 3M54NK.⁸⁷ The identification of the nuclear version is not known. In the 3M54 series, the specificities of the 3M54M show

85. Trident Alternatives Review, 16th July 2013.

86. An identical comparison could be made with the different versions of the Kh-55, a missile of the

same category deployed in air-to-ground/sea and sea-to-sea/ground variants in nuclear or conventional versions.

that it is clearly an anti-ship version and cannot be adapted to a nuclear mission. The same is not true of the 3M54 M1, a model that seems very similar to the 3M14. Two distinct problems arise in this case.



3M-14E Kalibr cruise missile

If the scope of the HCoC were to be extended, Russia would at least have to identify the 3M14 stockpile and distinguish between nuclear 3M14s, which would have to be reported, and conventional versions (3M14NK), which would not. This proposal would undoubtedly be met with scepticism in Moscow. Russia could fear that this modest level of transparency would undermine the credibility of its deterrent. The veracity of reported data could also give rise to heated debate, given the similarities between the nuclear and conventional versions.

This solution, therefore, is not wholly satisfactory. On the one hand, it leads to a large margin of approximation in the declaration of stockpiles. There are also multiple sources of confusion for platforms designed to carry 3M14s for strategic and conventional missions. The second problem would arise if Russia were to export the 3M54 to a nuclear power. Suspicion could taint any transfer of 3M54s, and both Russia

and the acquiring State could be accused of exporting 3M14NKs or 3M14s with nuclear capability. This is particularly problematic for India, which leases platforms that can accommodate all three types of missiles and has nuclear expertise. This issue is essentially covered by the MTCR rules. But it also concerns the positioning of States with respect to the HCoC. The British example shows that, to a certain extent, Member States could ask an acquiring State for further information if it became clear that work was under way to give the acquired weapons nuclear capability, or that an indigenous version with nuclear capability was being developed. Thus, the HCoC would complement the MTCR by facilitating the identification of nuclear-capable systems derived from conventional systems.

The respective cases of the *Tomahawk* and *Kalibr* illustrate the many difficulties associated with the introduction of cruise missiles into the Code when these systems are already used to deliver WMDs or when some of their versions could be used for this purpose. In view of the risk of confusion or the impossibility of assessing stockpiles, it would be quite logical to wish to exclude them from the HCoC requirements. However, the multiplication of this type of systems in nuclear-weapon States' arsenals, but also in non-nuclear powers', justifies their inclusion. India (with the *Nirbhay*), China (CJ-10/20), France (MdCN), the United States (*JASSM ER*) and South Korea (*Hyunmoo-3*) all produce missiles in this category sometimes with ranges of up to

87. The classification is not entirely clear. The Russians designate the long-range conventional missile as a variant of the *Kalibr*; i.e. the 3M54 (3M54NK), whereas it is seen in the West as a va-

riant of the 3M14. To simplify, the conventional version of the 3M14 is designated here 3M14NK to distinguish it from versions of the 3M54 which have a more tactical role.

1,000 km or more, some of which have dual capability. These States use or plan to use these weapons for conventional deep strike missions. They also expect to export these systems in the short to medium term. It would be pertinent to modify the text of the HCoC in a manner that would require these States to count them under the Code. It would indeed encourage them to distinguish between nuclear delivery systems and conventional ones.

These confidence-building measures are also necessary because of a more strictly technical issue, linked to payload modularity. Designed in the late 1970s, the *Tomahawk* innovated by offering a modular weapon system. Different types of warheads can be fitted to the same propulsion system. This approach is now standard, making it difficult to distinguish between categories of weapons. Modularity does not pose insurmountable problems with respect to nuclear proliferation, due to the difficulties in developing nuclear warheads referred to above. It is more problematic for chemical or bacteriological payloads. The advantage offered by these modular cruise missiles, featuring extended endurance and the ability to manoeuvre over the target for the dispersal of chemical and biological agents, entails a need for transparency measures to be defined as a function of the payload and not only as a function of the weapon system (propulsion system - payload).

Technical standards for the exclusion of certain types of cruise missile

The HCoC differs from the MTCR insofar as its implementation does not depend on any

technical standards. Sometimes decried as a weakness, this characteristic is also a strength. It allows for more systems to be covered, on a generic rather than a technical basis. However, in the case of cruise missiles, the generic definition can become a source of deadlock, as the category of equipment covered is too broad.

In order to respect the spirit of the HCoC, technical standards could be used solely as exclusion criteria. Thus, it would be necessary to define delivery vehicles that are not to be considered potential delivery vehicles for weapons of mass destruction. These weapons, not to be declared according to the Code, could technically speaking carry WMDs. But their adaptation would be of little military interest or would require an overly extensive technological transformation. This approach could help defining thresholds for payloads but also for diameters that would allow a missile to be considered unsuitable for WMDs. Standards of this type would exclude many anti-ship and air-to-ground systems that will never be used to deliver WMDs because of their technical specifications. In the case of chemical and bacteriological weapons, theoretical exclusion criteria related to the payload but also to the manoeuvrability of the weapon and its ability to loiter on zone could also be developed.

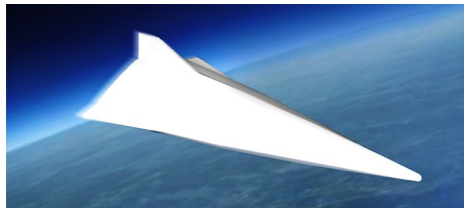
These technical factors would thus make it possible to define the scope of cruise missiles declared under the HCoC. Drawing up a list would not so much be relevant to establish the systems that are now operational as to include missiles developed in the future. This system would prove its utility if a State developing a long-range dual-capability system decided to declare it

under the Code because it would couple it with a nuclear capability. Clearly, this approach would pose problems for potential new entrants. China (a non-signatory to date), which has a potentially dual-capable system based on the CJ-10/20, is apparently not deploying them in a nuclear version. In the event of China joining an HCoC with an extended scope, this system could pose difficulties. China might wish to give the CJ-10/20 a nuclear capability without making it public, for reasons related to the evolution of its deterrence doctrine. The extension of the Code to cruise missiles could, therefore, deter a State such as China from joining the Code. However, this disadvantage would not be sufficient to outweigh the benefits of such an initiative.

As seen previously, the definition of functional but also technical standards to allow partial integration of cruise missiles into the Code would raise a number of difficulties, especially for some dual-capability systems. Nonetheless, relatively simple criteria would make the instrument more relevant to prevent WMD proliferation. With the use of technical data to exclude conventional missiles and the partial reliance on good faith, these criteria could naturally be contested. However, in the current political, strategic and military context, they seem to be the only way to account for these systems. Finally, it must be noted that such an approach should be regularly reassessed to integrate ongoing technological developments, and in particular the development of hypersonic systems.

Technological developments: taking into account hypersonic systems

The gradual emergence of hypersonic systems raises additional problems. These vehicles can be broken down into two major families. Scramjet-powered cruise missiles are comparable to current systems but flying faster (1.5 km/s) and at much higher altitudes (20 to 30 km), while hypersonic glide vehicles are initially deployed by a space launcher or a ballistic missile and complete most of their flight along a non-ballistic trajectory in the upper atmosphere. Scramjet-powered cruise missiles may be accounted for according to the criteria mentioned for conventional strategic cruise missiles. These can be developed for conventional or nuclear purposes. In the current state of technological progress, it is still possible to distinguish between the two types of weapon systems. The payloads of the systems currently under consideration are relatively small and the adaptation of a nuclear weapon would require a specific design. However, these systems are not very suitable as delivery vehicles for chemical or bacteriological agents, due to the small payload and relatively high terminal velocity. In the long term, if these missiles are equipped with nuclear weapons, their inclusion in the HCoC seems quite natural. Their range and velocity would make them well suited to surprise attacks. Nevertheless, in this configuration it would certainly be difficult to distinguish between nuclear and conventional versions. Indeed, the States that are currently developing them have proven capacities in warhead miniaturisation.



One configuration of the Chinese hypersonic glider DF-ZF

The inclusion of gliders, meanwhile, would require a near-consensus. These systems are expected to reach much higher velocities (from 1.5 to more than 4 km/s). They could have long ranges, in the order of at least 10,000 kilometres, and could be coupled to both nuclear and conventional weapons without any apparent change in their design. In this sense, these systems are quite similar to traditional ballistic systems, as they present the same type of threat and can be employed using the same kinds of operational procedures. The Russian Yu71, whose nuclear purpose is obvious, is a good illustration of the characteristics of this type of weapon.

However, some of the future gliders will probably not use a conventional ballistic/space launcher but will be launched by a booster from an airborne platform. The glider's operating logic will remain the same. The ranges and velocities of these systems will probably be reduced, making them suitable for tactical or theatre use. They will fulfil a conventional role in the short term, but their future conversion to nuclear missions is almost certain. The integration of cruise missiles into the HCoC would avoid the need to discuss the

relevance of including such systems, which tend to combine the functionalities of gliders and scramjets.

Conclusion

Cruise missile proliferation is an undeniable phenomenon. The number of systems is increasing, including dual-capable versions. Some of these systems are proposed to potential customers in modified versions that comply with MTCR standards. France and the United Kingdom are exporting the *SCALP EG* under the name *Storm Shadow*. They have already concluded deals with several European States and Saudi Arabia.⁸⁸ They also sold to the United Arab Emirates the *Black Shaheen*, a limited-performance version, in the late 1990s.⁸⁹ The demonstration of the MdCN in Syria could also promote it as a candidate for export. India is offering a version of the *BrahMos* with a range of 290 km for export. New Delhi agreed to sell the missile to Vietnam in 2016, after its entry into the MTCR.⁹⁰ Russia's use of *Kalibr* probably signals its desire to sell the missile. It developed an export version that complies with MTCR standards under the name "Club" and this model has already been exported. Meanwhile, China is currently testing an export version of the CX-1, with one customer already engaged in the procurement process. Some elements published by the manufacturer suggest that this foreign customer at least partly financed the missile's development.⁹¹ Finally, other countries are present on the

88. Missile Threat "APACHE AP/ SCALP EG/ Storm Shadow/ SCALP Naval/ Black Shaheen," *missilethreat.csis.com*, 2nd December 2016.

89. Id.

90. Ankit Panda, "Vietnam May Purchase India's Deadly Supersonic BrahMos Cruise Missile," *The Diplomat*, 2nd June 2016.

market, such as Ukraine, which is offering the *Korshun* for export and is developing a new version with a range of 500-700 km.

The MTCR has already helped to curb the spread of cruise missiles and dual-use goods capable of contributing to the proliferation of weapons of mass destruction. However, it is likely that the spread of cruise missile technologies will continue through the known channels. The MTCR rules are subject to divergent interpretations, some of which clearly favour exports, as has been seen in the past.⁹² Moreover, even if the models proposed for export apparently comply with the letter of the MTCR, they include technological building blocks that could form the basis for vertical proliferation in the acquiring countries. Illegal transfers are quite likely to take place. It is also possible that the technologies and know-how associated with these missile programmes may facilitate alternative proliferation mechanisms. For example, debris from missiles used in theatres of operation can be recovered and facilitate the diffusion of technology. As cruise missiles are regularly used, this is a real factor of proliferation for these missiles. Dennis Gormley points out that the dissemination of technological building blocks alone allows only a slow and uncertain proliferation of missiles.⁹³ However, this dissemination of technologies is likely to be accompanied by know-how, through international cooperation and exchanges of engineers. Considering this

risk would strengthen a transparency instrument such as the HCoC. Nevertheless, and in view of the specificities of cruise missiles, an extension of the scope could not be done without restrictions. If a standard is to be established, it should make it possible to rule out delivery systems intended to carry conventional weapons. It is precisely the unwillingness to report on these conventional weapons that makes States reluctant about including cruise missiles in the HCoC today.

It is difficult to establish technical thresholds based on the study of the characteristics of cruise missiles. Ranges are no longer significant, guidance systems are sophisticated and payloads substantial - even though there is some uncertainty about the characteristics of WMDs available for proliferators. Arguments based on technical thresholds only lead to the conclusion that any cruise missile is a potential delivery vehicle for chemical and bacteriological weapons, as well as nuclear weapons if more advanced warheads are developed.

The standard proposed in this paper refers to the actual function of delivery systems, making a distinction between cruise missiles designed to carry weapons of mass destruction and those that are not. Missiles specifically designed to carry nuclear weapons represent a risk and must be subject to universal transparency measures; conventional delivery systems should not be

91. Kenhmann, op. cit.

92. The United States accused France and the United Kingdom of manipulating the provisions of the MTCR to validate the sale of the *Black Shaheen* to the United Arab Emirates in 1998. See Jeffrey Lewis,

"Storm Shadow, Saudi and the MTCR," *Arms Control Wonk*, 31st May 2011.

93. Gormley, "Missile Contagion: Cruise Missile Proliferation and the Threat to International Security," op. cit., p.7.

subject to the same standard. Such a standard removes a significant number of missiles from the provisions of the HCoC, which is a disadvantage in terms of non-proliferation: several delivery systems that are virtually capable of transporting WMDs, and their technologies, would not be subject to the Code. However, the Code insists on establishing confidence-building measures among States, basing its implementation on their willingness and good faith, while enhancing the visibility of the various dual-capability programmes, which constitutes an additional obstacle to proliferation.

In the current context, such a framework would be more realistic than an extension to cover all cruise missiles. It would take into account some of the reservations noted

by the subscribing States. Even this more limited proposition of extension of the HCoC's scope would entail obstacles that should not be underestimated. It would be difficult to convince the community of HCoC Member States to amend the text. Some States consider that the priority is its universalisation in its current format. Others insist on its proper implementation by all subscribing States. Despite procedural simplifications, more than a quarter of States fail to submit their annual declarations. Others disagree on the type of launches requiring pre-notification. The debate concerning cruise missiles can thus only be a long-term undertaking, which will require increased awareness and political investment by one or more subscribing States. □

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THE HAGUE CODE OF CONDUCT

The objective of the HCoC is to prevent and curb the proliferation of ballistic missiles systems capable of delivering weapons of mass destruction and related technologies. Although non-binding, the Code is the only universal instrument addressing this issue today. Multilateral instrument of political nature, it proposes a set of transparency and confidence-building measures. Subscribing States are committed not to proliferate ballistic missiles and to exercise the maximum degree of restraint possible regarding the development, the testing and the deployment of these systems.

The Fondation pour la Recherche Stratégique, with the support of the Council of the European Union, has been implementing activities which aim at promoting the implementation of the Code, contributing to its universal subscription, and offering a platform for conducting discussions on how to further enhance multilateral efforts against missile proliferation.

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