



# STRATEGIC TECHNOLOGIES

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**NUCLEAR RISK REDUCTION POLICY BRIEF NO. 2**

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## HIGHLIGHTS

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- In today's more tense and complex relations among multiple nuclear-armed States, a focus of nuclear risk reduction efforts should be to improve strategic predictability.
- States should take steps—including within national structures—to enhance their understanding of the potential destabilizing impacts of individual technologies and to lengthen the fuse in crisis escalation situations.
- Nuclear-armed States should consider how they can clarify or restrict behaviours linked to new strategic capabilities. This can also build confidence towards the potential adoption of restrictions on the deployment or use of new capabilities that contribute to ambiguity in nuclear crisis.

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## CONTEXT

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Military competition among several of the nuclear-armed States, fuelled by greater uncertainty about each other's intentions and capabilities, is making the world a more dangerous place. The risk is rising of those States stumbling into crisis and conflict and, correspondingly, of nuclear weapon use in those circumstances, whether deliberately or inadvertently. Intertwined with these dynamics is the potentially destabilizing impact of several current or imminent strategic technological developments ostensibly intended to strengthen deterrence. This policy brief outlines some risks linked to these developments, in crisis situations and in terms of longer-term strategic predictability and international stability, and suggests measures in support of nuclear risk reduction.

# TECHNOLOGICAL DEVELOPMENTS, CRISES, AND NUCLEAR RISK

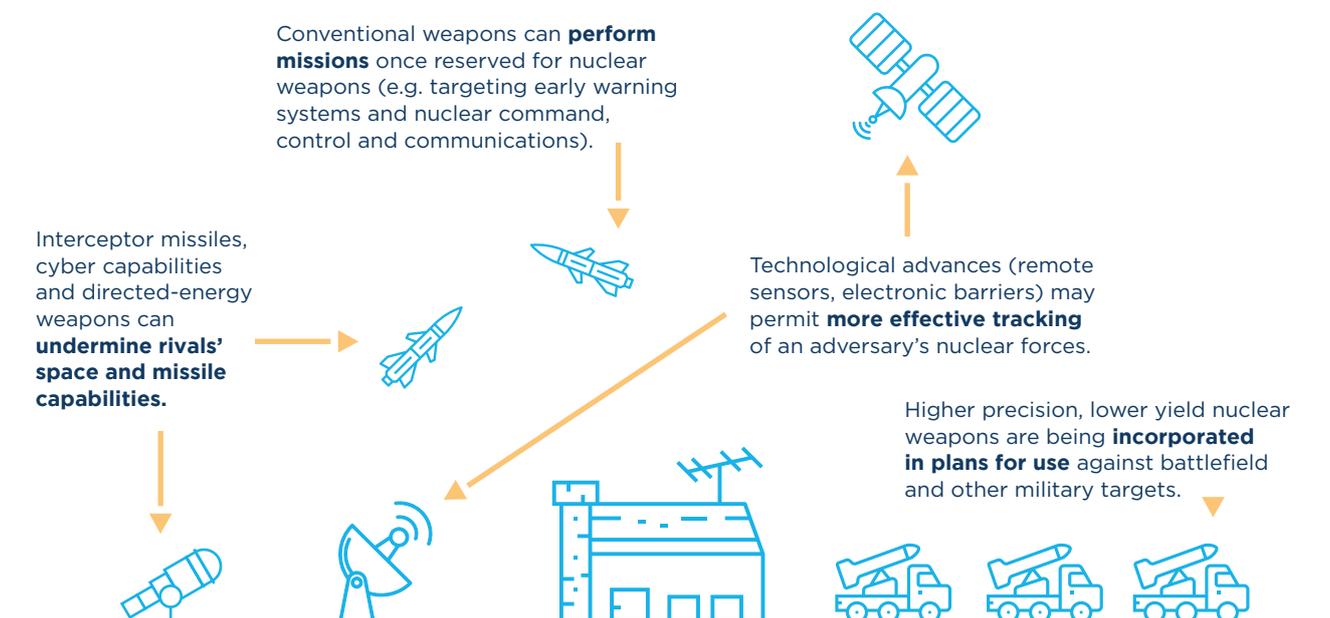
## Force Vulnerability

The deployment or use of certain new strategic technologies may be perceived by nuclear-armed States as a threat to their retaliatory capabilities; in crisis this can conceivably prompt ‘use it or lose it’ dilemmas (providing incentive for a pre-emptive strike). In some instances, this is exacerbated by uncertainty among States potentially targeted by new delivery systems about their payloads (nuclear or conventional) and intended targets. Alongside this, the increased prevalence of offensive cyber operations underlines the possibility that nuclear early-warning and C3 systems might be hacked, spoofed, or otherwise subverted. These operations could undermine the confidence of targeted operators in the integrity of these systems; if undetected, the operations might distort perceptions and decision-making in disastrous ways. Greater use of artificial intelligence for decision-support in nuclear roles could exacerbate this vulnerability.<sup>1</sup>

## Cross-Domain Interactions

Entangled interaction across nuclear and conventional domains can drive escalation possibilities, for instance if attacks targeting non-nuclear assets are misinterpreted. This possibility is increasing. Significantly, some military space infrastructure is critical to C3 for both conventional and nuclear forces. The announcements that national ‘space forces’ will be formed in States such as the United States, France and India reflect growing concerns about the vulnerability of this infrastructure to new technologies. Threats to such infrastructure include ground-launched anti-satellite interceptors and a variety of ‘non-kinetic’ cyber and electronic counter-space capabilities. In a major power conventional conflict, it is likely that adversaries will seek to neutralize each other’s satellites in orbit. This could undermine nuclear early-warning systems.

## Technological Developments, Nuclear Weapons, and the Strategic Balance



<sup>1</sup> V. Boulanin, *The Impact of Artificial Intelligence on Strategic Stability and Nuclear Risk, Volume I, Euro-Atlantic Perspectives*, SIPRI, May 2019, <https://www.sipri.org/publications/2019/other-publications/impact-artificial-intelligence-strategic-stability-and-nuclear-risk-volume-i-euro-atlantic>.

**“The risk is rising of those States stumbling into crisis and conflict and, correspondingly, of nuclear weapon use in those circumstances.”**



President’s Secretariat (GODL-India)

## ‘Usability’ of Nuclear Weapons

In the Russian Federation the use of nuclear weapons is envisaged in conflict in conjunction with conventional forces in certain circumstances.<sup>2</sup> The United States for its part has deployed lower-yield nuclear weapons.<sup>3</sup> The rationale is that these offer an additional rung on the escalation ladder in a crisis.<sup>4</sup> But this arguably makes nuclear weapons more ‘usable’ as plans are put in place for their use against battlefield and other military targets. Their deployment can also contribute to inadvertent escalation, as nuclear use—once started (whatever the motive and explosive yield)—could easily get out of hand. For instance, Trident-equipped US ballistic missile submarines carry both new W76-2 five-kiloton warheads and much higher-yield ‘strategic’ nuclear-tipped missiles: use of the former might be interpreted as a general nuclear attack using the latter by a targeted nuclear-armed State.<sup>5</sup>

<sup>2</sup> N.N. Sokov, “Russia Clarifies Its Nuclear Deterrence Policy”, Vienna Center for Disarmament and Non-Proliferation, 3 June 2020, <https://vcdnp.org/russia-clarifies-its-nuclear-deterrence-policy>; A. Arbatov, “Understanding the U.S.–Russia Nuclear Schism”, *Survival*, vol. 59, no. 2, 2017.

<sup>3</sup> A. Woolf, *Nonstrategic Nuclear Weapons*, Congressional Research Service, 2019, 6 September 2019, <https://fas.org/sgp/crs/nuke/RL32572.pdf>.

<sup>4</sup> N.N. Sokov, “Why Russia Calls a Limited Nuclear Strike De-Escalation”, *Bulletin of the Atomic Scientists*, 13 March 2014, <https://thebulletin.org/2014/03/why-russia-calls-a-limited-nuclear-strike-de-escalation/>; US Joint Chiefs of Staff, Nuclear Operations, Joint Publication 3-72, 11 June 2019, [https://fas.org/irp/doddir/dod/jp3\\_72.pdf](https://fas.org/irp/doddir/dod/jp3_72.pdf).

<sup>5</sup> W.M. Arkin and H.M. Kristensen, “U.S. Deploys New Low-Yield Nuclear Submarine Warhead”, *Federation of American Scientists*, 29 January 2020, <https://fas.org/blogs/security/2020/01/w76-2deployed/>.

## What are They? Illustrative Examples of Strategic Technologies Concerns



### MISSILE DEFENSE SYSTEMS

#### Features

Wider spread, interoperability

#### Concerns

- Impact on retaliatory capabilities
- Linked systems



### HYPERSONIC GLIDE VEHICLES

#### Features

Speed, trajectory, manoeuvrability

#### Concerns

- Payload and target ambiguity
- Short reaction time



### CYBER OFFENSIVE CAPABILITIES

#### Features

Greater ubiquity and persistence

#### Concerns

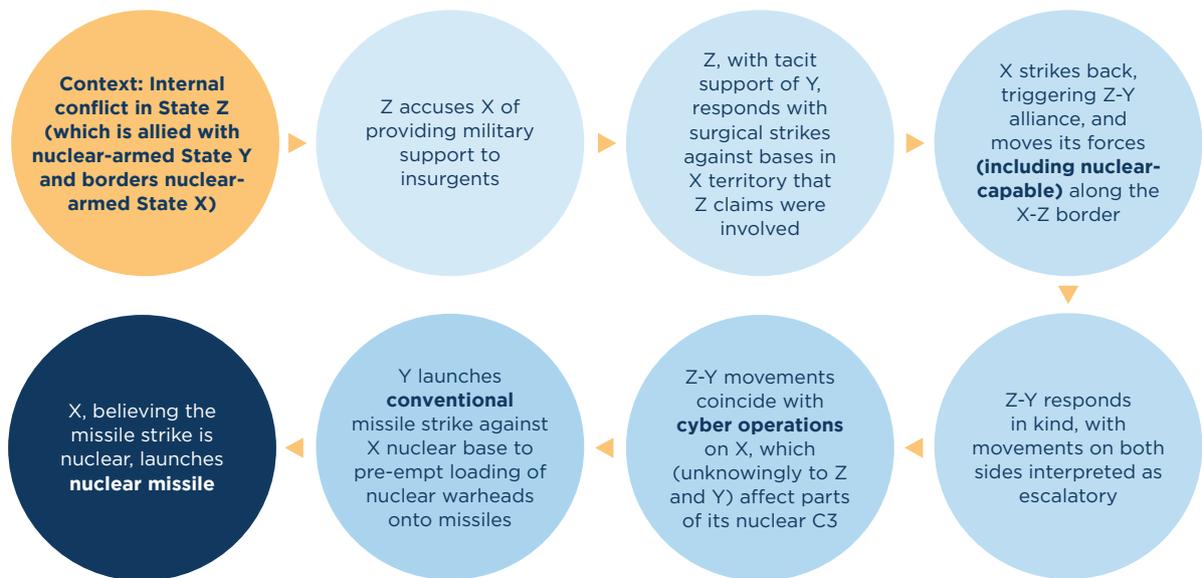
- Systems vulnerability
- Impact on critical infrastructure

# SYSTEMIC EFFECTS AND LONGER-TERM RISK

The development and deployment of technologies that affect aspects of nuclear relationships between strategic rivals create action–reaction dynamics that can sometimes be destabilizing. To account for new contingencies, nuclear-armed States may adjust their doctrines and operations. The US 2018 Nuclear Posture Review pointedly refused to rule out a nuclear response to ‘non-nuclear strategic attacks’—something that could conceivably include a major cyberattack.<sup>6</sup> While a subsequent US State Department paper characterized this as a “clarification” of US declaratory policy, this illustrates that nuclear-armed States may expand the scope of the circumstances in which they are willing to use nuclear weapons in responding to new technological threats.<sup>7</sup>

Additionally, strategic technological developments can create new ambiguities that prompt responses by other nuclear-armed States that are seen as escalatory, including by blurring nuclear and non-nuclear lines. For example, elements of US missile defence systems are becoming more integrated, with homeland defence integrating systems intended to intercept intercontinental missiles and theatre-level systems for use against non-nuclear missiles.<sup>8</sup> This has impacted on threat perceptions in China and the Russian Federation.<sup>9</sup> Another example: China comingles some aspects of its nuclear and conventional missile forces (such as C3 functions and deployment on land-based mobile launchers), which could contribute to confusion and inadvertent escalation in crisis.<sup>10</sup>

## Strategic Technologies and Nuclear Escalation



<sup>6</sup> US Department of Defense, Nuclear Posture Review 2018, February 2018, pp. 20–21: <https://media.defense.gov/2018/Feb/02/2001872886/-1/-1/1/2018-NUCLEAR-POSTURE-REVIEW-FINAL-REPORT.PDF>.  
<sup>7</sup> US Department of State, “Verification and Compliance, Strengthening Deterrence and Reducing Nuclear Risks: The Supplemental Low-Yield US Submarine-Launched Warhead”, Arms Control and International Security Papers, vol. 1, no. 4, 24 April 2020, <https://www.state.gov/wp-content/uploads/2020/04/T-Paper-Series-4-W76.pdf>.  
<sup>8</sup> See US Department of Defense, 2019 Missile Defense Review: Executive Summary, pp. viii–xiii: [https://www.defense.gov/Portals/1/Interactive/2018/11-2019-Missile-Defense-Review/The%202019%20MDR\\_Executive%20Summary.pdf](https://www.defense.gov/Portals/1/Interactive/2018/11-2019-Missile-Defense-Review/The%202019%20MDR_Executive%20Summary.pdf).  
<sup>9</sup> See “Putin: Russia will Consider Tackling NATO Missile Defense Threat”, RT News, 13 May 2016, <https://www.rt.com/news/342915-putin-nato-threat-missiles/>; G. Mullany and C. Buckley, “China Warns of Arms Race After U.S. Deploys Missile Defense in South Korea”, New York Times, 7 March 2017, <https://www.nytimes.com/2017/03/07/world/asia/thaad-missile-defense-us-south-korea-china.html>.  
<sup>10</sup> See E. Heginbotham et al., China’s Evolving Nuclear Deterrent: Major Drivers and Issues for the United States, RAND Corporation, 2017, p. 158, [https://www.rand.org/pubs/research\\_reports/RR1628.html](https://www.rand.org/pubs/research_reports/RR1628.html).

# RECOMMENDATIONS

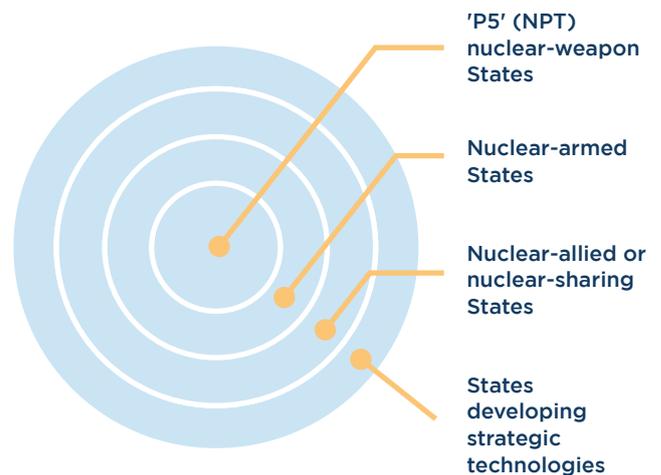
## Enhance Understanding of the Implications

**Consider Individual Capabilities.** States developing strategic capabilities may choose to exercise restraint in their own interests if they understand weapons conceived to strengthen nuclear deterrence in peacetime can be deeply destabilizing in crisis situations. Clearer understandings are needed within national nuclear decision-making systems of the broader implications of technological developments on transparency, predictability and stability. This is especially the case for systems being developed and procured in numbers and for missions that may still be somewhat interchangeable, including advanced long-range missiles of various kinds, missile defense and satellite interceptors and other counter-space capabilities.

**Rebuild Strategic Empathy.** Lengthening the nuclear fuse in a crisis requires greater understanding among policymakers in the States involved about each other’s underlying drivers and constraints. Means to achieve this among those in current strategic rivalry (see Policy Brief No. 1) include measures such as the creation of bilateral senior arms control advisory boards, which in addition to nuclear questions could look at the likely impacts of the range of strategic issues that divide States.<sup>11</sup> Intensified military-military dialogue among nuclear-armed States is also needed, and useful short-term objectives could be on the improvement of secure hotline arrangements among those in dyads (e.g. India-Pakistan, China-United States) and strategic chains (e.g. India-Pakistan-China-United States).

**Expand the Dialogue.** There are ongoing discussions among the five NPT nuclear-weapon States about aspects of nuclear risk reduction such as their doctrines, but these discussions do not encompass the other four nuclear-armed States (the Democratic People’s Republic of Korea, India, Israel and Pakistan). Moreover, the spread and impact of new strategic technologies extend beyond the nine nuclear-armed States. Most likely an approach is needed in which there are different configurations of States involved

in risk reduction discussions as appropriate. One possibility to give such efforts greater momentum and structure would be an international conference on nuclear weapon risk reduction that could look at the impact of these capabilities in a format that includes all interested States. Such a process could also serve to generate additional, independent research that might bring to light new findings and suggestions for ways forward.



U.S. Air Force

<sup>11</sup> L. A. Dunn, *Reversing the Slide: Intensified Great Power Competition and the Breakdown of the Arms Control Endeavor*, UNIDIR, 2019, <http://www.unidir.ch/files/publications/pdfs/reversing-the-slide-en-755.pdf>.

## Clarify and Restrict Behaviours

**Broaden the ‘P5’ Agenda.** The five NPT nuclear-weapon States’ discussions need to factor in emerging strategic technologies with implications for the strategic balance and crisis management. Given the closed and opaque nature of the current process, it is hard to say to what extent this currently occurs (and, to underline, these consultations do not include non-NPT nuclear-armed States, which is an obvious constraint). But clarification of doctrine can plausibly be expected to shed light on which of their capabilities most exacerbate tensions, and which ones in crisis would create significant ambiguity. This could provide a lead for other nuclear-armed States to follow.

**Limit ‘Ambiguous’ Deployments.** Nuclear-armed States could lessen the risk of inadvertent escalation by committing not to deploy non-strategic (‘tactical’) nuclear weapons, which depend on means of delivery (such as cruise missiles) that can generate ambiguity in crisis since many such systems are dual-capable. In regions such as Europe, non-nuclear strategic weapons should be moved away from their launchers and secured in central locations. China and India, for their parts, could confirm that their non-strategic delivery systems do not carry nuclear warheads and are not deployed. Similar declarations could be issued for hypersonic weapons. Verification could take the form of managed inspections under controlled conditions of factory or storage sites (as in New START). Absent formal agreements, some level of assurance could still be provided through national technical means of reconnaissance and intelligence collection.

**Establish Domain Parameters.** Public declarations by States that they will not be the first to use capabilities they may judge or agree are especially escalatory against other’s nuclear C3 infrastructure could signal restraint and have a confidence-building effect. Combined with deployment limits of various kinds, such declarations could provide a level of reassurance in the event of the testing and use of these systems. Voluntary transparency and confidence-building measures could help to reduce risk of entangled interactions stemming from counter-space capabilities as well. States with co-orbital drones could provide advance notice of their manoeuvres close to others’ space objects, those with anti-satellite capabilities could adopt test guidelines, and those with counter-space capabilities could publish their policies on use.

## Restrict Capabilities

**Extend New START.** New START provides an important mechanism for clarification and engagement between the United States and the Russian Federation on their strategic nuclear systems. The verification of each other’s deployment of strategic nuclear launchers offers an important element of predictability in their strategic relations (also providing broader reassurance, including to other nuclear-armed States). If extended for a further five years, New START would ensure important restrictions are maintained and would buy time for the Russian Federation and the United States to consult on how to take account of new strategic developments, including HGVs, as well as to bring others into their strategic arms control process.

**Lay Arms Control Groundwork.** New START definitions (of equipment and facilities) might be applied or adapted in developing understandings reached separately with China and other nuclear-armed States. These understandings could also include acknowledgements of mutual nuclear vulnerability; greater transparency; joint measures to reduce nuclear risk explicitly based on greater awareness of the implications of strategic technologies like cyber, anti-satellites and HGVs; and commitments not to build up nuclear forces. As one Chinese analyst noted: “reciprocal unilateral measures can be taken to build confidence and open the door for better understanding and communication, paving the path for the future of arms control”.<sup>12</sup>

**Contain Proliferation of Certain Technologies.** States developing hypersonic technology (not all of them nuclear-armed States) should exercise special restraint on transfer due to its characteristics. Indeed, this has become a more prominent issue in strategic export control regimes such as the MTCR. Engagement with China, a MTCR non-member, is also needed. Separately, there is a push by some States to ban nuclear-armed cruise missiles whether launched by land, sea, or air, as they are seen as particularly destabilizing and carrying a higher risk of resulting in nuclear weapons use via miscalculation or misinterpretation. Nuclear-armed States not yet possessing nuclear-armed cruise missiles could agree not to develop or acquire them. This could complement unilateral actions to limit systems by other nuclear possessors and broader political pledges that might, in time, presage legally binding arrangements.

<sup>12</sup> W. Riqiang, “Trilateral Arms Control Initiative: A Chinese Perspective”, *Bulletin of the Atomic Scientists*, 4 September 2019, <https://thebulletin.org/2019/09/trilateral-arms-control-initiative-a-chinese-perspective>.

## THE LIMITS OF RISK REDUCTION

Nuclear early-warning and C3 systems are highly complex and are environments in which failures that can lead to accidents are arguably inevitable. From the limited amount that is known from the historical record due to the highly secretive practices of the nuclear-armed States in this regard, failures in nuclear C3 systems have brought the world close to nuclear use on several occasions—thus underlining the importance of human judgement under pressure as a safeguard.<sup>13</sup> The introduction of new technologies will create new complexities, including novel forms of system failure and ‘hidden interactions’. This could make the job of nuclear decision makers already under intense pressure even more difficult.

<sup>13</sup> P. Lewis et al., *Too Close for Comfort: Cases of Near Nuclear Use and Options for Policy*, Chatham House, 2014. <https://www.chathamhouse.org/publications/papers/view/199200>.

## Acronyms

<b>C3</b>	Command, Control, and Communications
<b>HGV</b>	Hypersonic Glide Vehicles
<b>MTCR</b>	Missile Technology Control Regime
<b>NPT</b>	Treaty on the Non-Proliferation of Nuclear Weapons
<b>START</b>	New Strategic Arms Reduction Treaty

## About this brief

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## Note

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