

**FOR BETTER OR FOR WORSE: THE FUTURE OF C3I
ENTANGLEMENT
JAMES M. ACTON
NOVEMBER 21, 2019**

INTRODUCTION

In this essay, James Acton evaluates the risk of inadvertent escalation arising from attacks on dual-use (nuclear and conventional warfare) command, control, communication, and intelligence (C3I) capabilities in a conventional war because such attacks would degrade the target's nuclear command-and-control system.

James Acton is co-director of the Nuclear Policy Program at the Carnegie Endowment for International Peace.

A podcast with James Acton, Peter Hayes, and Philip Reiner on nuclear-conventional entanglement and NC3 is found [here](#).

Readers may also be interested in an extended treatment of entanglement by James Acton [here](#).

Acknowledgments: The workshop was funded by the John D. and Catherine T. MacArthur Foundation.

This report is published simultaneously [here](#) by Technology for Global Security and [here](#) by Nautilus Institute and is published under a 4.0 International Creative Commons License the terms of which are found [here](#).

The views expressed in this report do not necessarily reflect the official policy or position of Technology for Global Security. Readers should note that Tech4GS seeks a diversity of views and opinions on significant topics in order to identify common ground.

The views expressed in this report do not necessarily reflect the official policy or position of the Nautilus Institute. Readers should note that Nautilus seeks a diversity of views and opinions on significant topics in order to identify common ground.

Banner image is by Lauren Hostetter of [Heyhoss Design](#)

**TECH4GS SPECIAL REPORT BY JAMES ACTON
FOR BETTER OR FOR WORSE: THE FUTURE OF C3I ENTANGLEMENT
NOVEMBER 21, 2019**

Summary

In a conventional conflict between the United States and China or Russia, each belligerent might attack the other's command, control, communication, and intelligence (C3I) capabilities to gain a

warfighting advantage. However, because a number of C3I assets are dual-use, such attacks would degrade the target's nuclear command-and-control system, creating serious risks of inadvertent escalation. Looking forward, at least four factors will influence the severity of the risks created by such entanglement.

First, geopolitical developments will have indirect effects, including altering (for better or worse) the likelihood of war. Second, improvements in nonnuclear weapons, such as the development of long-range hypersonic gliders, could increase the threat posed to nuclear C3I capabilities. Moreover, because early-warning assets involved in nuclear operations might be able to track such weapons, they could become more likely to be subject to attack. Third, states' conventional or nuclear doctrines could change, including by increasing or reducing the role accorded to attacks on C3I assets. Finally, unilateral or cooperative risk-mitigation measures could be implemented. Unilateral measures are the most promising under current political circumstances and could be as simple as raising awareness of the risks associated with entanglement within defense and military establishments.

Defining the Problem

The risk of inadvertent escalation in a conventional conflict is growing as a result of increasing entanglement between nuclear command, control, communication, and intelligence (C3I) capabilities and nonnuclear weapons.¹ In the U.S.-Russian and U.S.-Chinese dyads, there are four drivers to this increasing risk:

1. Improvements in nonnuclear weapons—including anti-satellite capabilities, cyber weapons, and high-precision conventional munitions—are posing an increasing threat to C3I capabilities (irrespective of their purpose).
2. The United States' nuclear C3I system—and probably also its Russian and Chinese equivalents—is growing increasingly reliant on dual-use assets, such as communication capabilities used for nuclear and nonnuclear operations.
3. Post-Cold War efforts to reduce costs have driven down the degree of redundancy in the U.S. nuclear C3I system (there is insufficient open-source information to assess how the redundancy of the Russian and Chinese systems have changed over the same time period).
4. China, Russia, and the United States are developing conventional warfighting doctrines that envision attacks on the C3I assets—including dual-use ones—used to enable an adversary's nonnuclear operations.

Collectively, these developments are increasing both the likelihood and consequences, in a conventional conflict, of “incidental attacks,” in which one belligerent launches nonnuclear attacks against its adversary's dual-use C3I assets for the purpose of undermining that adversary's nonnuclear operations. Such attacks would, however, also degrade the opponent's nuclear command-and-control system, creating potentially catastrophic—if inadvertent—escalation risks.

¹ James M. Acton, “Escalation through Entanglement: How the Vulnerability of Command-and-Control Systems Raises the Risk of an Inadvertent Nuclear War,” *International Security*, vol. 43, no. 1 (Summer 2018): 56-99.

Escalation could result from not only incidental attacks by the United States on dual-use Chinese or Russian C3I assets, but also from Chinese or Russian strikes on U.S. assets. In fact, it is highly likely that these risks would be present in a conflict between any pair of nuclear-armed states—though I have not undertaken the research necessary to understand the degree of entanglement in other contexts and so characterize the severity of the risks.

In any case, over the next decade or two, the extent to which these risks increase or decrease will likely depend on at least five factors: geopolitical developments, technological developments, doctrinal developments, unilateral risk reduction, and cooperative risk reduction.

Geopolitical Developments

Geopolitical developments—the evolution of political relations between pairs of potentially hostile nuclear-armed states—will not affect entanglement directly. They will, however, have multiple important indirect effects, including altering (for better or worse) the likelihood of a conventional war, the perceived desirability of unilateral risk reduction, and the feasibility of cooperative risk reduction. Geopolitical developments will be less amenable to control—especially by the officials responsible for managing the risks created by entanglement—than the other factors discussed below. In fact, for current purposes, they may best be thought of as a “boundary condition” to which states must adapt, rather than a “variable” which can, at least to some extent, be tuned.

Technological Developments

The emergence of new types of nonnuclear offensive weapons could significantly increase the threat to dual-use C3I capabilities. The deployment of long-range hypersonic weapons is the most likely such development. These weapons could further reduce the survivability of ground-based C3I assets, such as satellite uplinks and downlinks as well as radars and communication transmitters. Even more consequentially, long-range hypersonic air-defense interceptors, plausibly based on scramjet or boost-glide technology, could threaten airborne command-and-control assets, which are currently the least vulnerable form of communication capability.

Improvements in existing types of weapons could exacerbate the risks. The United States, for example, could plausibly follow Russia and China in developing kinetic capabilities to attack satellites in geostationary or highly elliptical orbits, where critical early-warning and communication are located. Meanwhile, all three states appear to have an interest in developing nonnuclear ballistic missiles of increasingly long ranges.

Developments in nonnuclear weapons could do more, however, than simply increase the ability of one state to attack another’s C3I assets; they could also increase that state’s incentives to launch such attacks. For example, early-warning satellites would probably be the best existing means to detect the launch of long-range boost-glide weapons and possibly also to monitor them later in flight (such weapons would be largely invisible to ballistic missile early-warning radars, or BMEWRs, and air-defense radars). If the United States deploys nonnuclear boost-glide weapons, therefore, Russian and possible Chinese early-warning satellites, which hitherto may not have played any part in nonnuclear operations, will almost inevitably gain a new role in monitoring nonnuclear attacks, creating new incentives for Washington to launch incidental attacks against those satellites.

The development of longer-range nonnuclear ballistic missiles could have similar consequences. For technical and geographic reasons, Chinese and Russian BMEWRs would generally be unable to detect existing U.S. nonnuclear weapons (though are capable of tracking many U.S. space assets). Meanwhile, only one U.S. BMEWR, the one at Fylingdales in the United Kingdom, is currently likely to play a significant role in defending against nonnuclear ballistic missiles. If China, Russia, or the United States develops nonnuclear ballistic missiles with longer ranges, additional BMEWRs are likely to gain a role in detecting incoming nonnuclear strikes, creating the possibility of their being subject to incidental attacks in a conflict. These risks would be further exacerbated by improvements in early-warning technology that enabled BMEWRs—and also early-warning satellite—to contribute to nonnuclear operations more effectively. To be sure, not all imaginable technological developments would exacerbate escalation risks. It is not impossible, for example, that the offense-defense balance in the cyber domain could shift toward defense (even if offense still retains an advantage). This development would help mitigate the danger of incidental cyberattacks on C3I assets. Nonetheless, technological developments are highly likely, on balance, to increase escalation risks—though there are open questions over the pace of change.

Doctrinal Developments

The escalation risks stemming from entanglement are a function not only of technology; doctrinal developments—in particular, an apparently growing emphasis on attacking C3I assets within conventional warfighting plans—are a critical driver. The severity of these escalation risks will depend, therefore, on whether this trend continues or reverses.

The future trajectory of doctrine is probably less predictable than its technological equivalent, and it is conceivable that states will opt to reduce the role of attacks on C3I assets in their war plans—though difficult trade-offs could arise. For example, the United States (as well as NATO more generally) has only a limited force presence in and around the Baltic States; its plan to defend these nations from a Russian attack relies on rapid reinforcement. In a conflict, this posture would probably lead the United States to launch conventional strikes deep within Russia—including against C3I assets—to buy time for reinforcements to arrive (and, incidentally, increases the role of nuclear weapons in U.S. defense strategy). While a larger conventional force presence in the region would unquestionably be provocative from a Russian perspective, it would have the significant advantage of reducing the need for the United States to attack Russian C3I assets in a conflict (and could enable the United States to reduce its reliance on nuclear weapons).

Finally, changes in nuclear doctrine—particularly whether a state plans to launch under a nuclear attack or ride it out before retaliating in kind—could also influence escalation risks. China, for example, appears to be contemplating a switch to a launch-under-attack posture and is developing the necessary technological capabilities to enable it to do so (although it is probably more likely to adopt a launch-under-attack posture temporarily during a crisis than to maintain it on a day-to-day basis). If China does make this change, incidental attacks by the United States against dual-use Chinese early-warning assets could generate crisis instability by raising fears in Beijing that it would lose its nuclear forces unless it used them. Conversely, if the United States or Russia reduced their emphasis on launch-under-attack plans—or even abandoned those plans entirely—the escalation risks of incidental attacks would be reduced.

Unilateral Risk Reduction

The simplest unilateral risk-reduction measure would be to increase awareness—within defense and military establishments—of the inadvertent escalation risks created by entanglement. In a conflict, the awareness that an adversary’s attacks on dual-use C3I assets might be motivated by conventional warfighting goals—and not by preparations for a nuclear war—could reduce the likelihood of a provocative response that catalyzed further escalation. Similarly, the awareness that an adversary could misinterpret the state’s own motivations in launching attacks on dual-use C3I assets could prompt both restraint in a conflict and the development of less escalatory war plans ahead of time. Awareness could also affect acquisitions. For example, states could develop C3I architectures less likely to be subject to incidental attack and/or more capable of withstanding it. To lead the process, a senior official—such as the Under Secretary of Defense for Policy within the United States—could be made responsible for raising awareness and ensuring that efforts to manage the risks of inadvertent escalation were integrated across all relevant military activities.

Declaratory policy could have a role to play in raising awareness, among potential adversaries, of the risks of attacking a state’s dual-use C3I assets. Indeed, the 2018 U.S. Nuclear Posture Review tries to do this by threatening the possible use of nuclear weapons in response to nonnuclear attacks on nuclear-related C3I assets. This particular threat is disproportionate and risks being dismissed as bluster, but less bellicose language could be more helpful.

Cooperative Risk Reduction

In the current political climate, cooperative U.S.-Russian and U.S.-Chinese risk-reduction efforts would be exceptionally challenging; in fact, even starting serious discussions aimed at building joint understanding about the risks would constitute a major breakthrough. Nonetheless politics could change. Frozen relations might thaw, creating new opportunities for engagement.

Alternatively, a crisis, near miss or even the actual use of nuclear weapons could scare leaders into action (though it would obviously be preferable if change were catalyzed in other ways.)

As and when politics next become more permissive, one approach would be for pairs of states to focus on developing cooperative risk-reduction measures to try and address specific dangers (such measures could be legally binding, politically binding or focused on norm building).

Possible measures include:

- The inclusion of long-range boost-glide weapons under the central limits of any future U.S.-Russian strategic arms control treaty (as a way to limit their numbers and make deployments more transparent).
- An agreement not to test anti-satellite weapons above a certain altitude (as a means of enhancing the security of the most important dual-use C3I satellites, which are generally located in geostationary or highly elliptical orbits).
- A norm against any form of cyber interference with C3I assets.

The second and third of these proposals, in particular, would be very challenging to define and implement (as I have described elsewhere). It would be overly pessimistic, however, to assume a priori that such difficulties could not be overcome under better political conditions.

An alternative approach would be a more ambitious effort—such as Peter Hayes’ proposed code of conduct — to address the escalation risks associated with the vulnerability of command-and-control systems synoptically and globally. This approach and the step-by-step approach are not necessarily mutually exclusive: a code of conduct could be developed in a

bottom-up way through the accretion of targeted risk-reduction measures; conversely, a code could catalyze the creation of concrete risk-reduction measures in a top-down way. Nonetheless, given limited political capital, it will be difficult to pursue both approaches simultaneously, creating an important question about priorities.

III. ENDNOTES

IV. TECH4GS INVITES YOUR RESPONSE

Technology for Global Security invites your responses to this report. Please send responses to: info@tech4gs.org. Responses will be considered for redistribution to the network only if they include the author's name, affiliation, and explicit consent