

Artificial Intelligence in Nuclear Operations

CHALLENGES, OPPORTUNITIES, AND IMPACTS

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Abstract

The US, Russia, and China have all recognized the revolutionary promise of artificial intelligence (AI). It is likely, as each seeks areas of advantage through AI, that they will explore nuclear applications of AI. Consequently, the US State Department's Bureau of Arms Control, Verification, and Compliance (AVC) asked CNA to conduct research and analysis that would sharpen its understanding of how AI could affect nuclear risks and how AVC could reduce those risks and capture security-enhancing benefits. This report characterizes how all three competitors are using AI in nuclear operations; how they might do so in the future; and how their uses of AI could increase, decrease, or otherwise affect nuclear risks. It also recommends ways the US government might mitigate the risks of AI-enabled nuclear operations and capturing possible risk-reducing benefits.

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Cover image: An Air Force officer operates a terminal for the Semi-Automatic Ground Environment, the world's first networked computer system. Beginning in the late 1950s, it aggregated data from hundreds of radars to coordinate the defense of North America against nuclear-armed Soviet bombers. Photo credit: MIT Lincoln Lab.

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Executive Summary

The US, the Russian Federation, and the People's Republic of China (PRC) have all recognized the revolutionary promise of artificial intelligence (AI), with machines completing complex tasks and matching or exceeding human performance. In parallel, all three competitors are modernizing their nuclear forces. It is likely, as each seeks areas of advantage through AI, that they will explore nuclear applications. AI applications—in both nuclear operations and AI-enabled military capabilities more broadly—could increase or decrease nuclear risk.

Research questions

Against this background, the US State Department's Bureau of Arms Control, Verification, and Compliance (AVC) asked CNA to conduct research and analysis that would sharpen its understanding of how AI could impact nuclear risks. To that end, CNA addressed three questions:

- 1. How are the US, Russia, and PRC using AI to enable their respective nuclear operations today?
- 2. How might US, Russian, and PRC enabled nuclear postures interact—especially during crises or conflict—in the circa 2035 timeframe? In what specific ways might AI increase or decrease nuclear risk?
- 3. What steps can the US government take to mitigate AI-driven nuclear risks and/or capture any risk-reducing benefits of AI-enabled nuclear operations?

Project contributions

This project makes two basic contributions. The first is a deep exploration of the many complicated ways that AI could influence nuclear risk that goes beyond what can be found in prior research on the topic. Building on that exploration, the second contribution is a set of recommendations that will help the US government mitigate the risks and capture the risk-reducing benefits of AI-enabled nuclear operations.

Findings

Departing from the observation that AI-enabled nuclear operations could have both positive and negative effects on overall nuclear risk, we identified mechanisms by which AI-enabled