Conflict Transformation Research Grant Report
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Avoiding Conflict through Verification: Assessing and Updating Proposed Biological Weapons Convention Verification Measures

Statement of research question and its importance

The Biological Weapons Convention (BWC) is an agreement not to use biological and toxin weapons in conflict, and also not to develop or stockpile them. Unlike the similar Chemical Weapons Convention, the BWC contains no protocol for inspection, and no systematic verification measures aside from voluntary annual declarations of activities called Confidence-Building Measures (CBMs), which are submitted by less than 50% of BWC states parties. In 1991, the Third Review Conference of the BWC established a working group (VEREX) to investigate potential verification measures, and between 1995 and 2001 the group developed a draft protocol for verification system including site visits. The group evaluated 21 potential verification measures, ranging from off-site surveillance and data sharing to on-site inspections, sampling, and continuous monitoring. The draft protocol was circulated among states parties, but was rejected by the Bush Administration, citing national security and commercial interests in protecting non-public information about the activities at potential inspection sites, such as government research labs and pharmaceutical companies. The US's rejection of the protocol indefinitely tabled the drafting process, and the BWC has remained without verification measures for the past 22 years.

In that time, technology has greatly improved, both for biological manufacturing and for inspection, sampling, and surveillance applications. There have also been several accusations of non-compliance with the BWC, both by Russia (against the US) and by the US (against Iran, Iraq, Libya, Syria, and North Korea, with additional concerns raised about China and Russia). During the COVID-19 pandemic, Russia accused the US of operating bioweapons research facilities in Ukraine, and concerns were raised about research on coronaviruses at the Wuhan Institute of Virology. While many of these concerns and accusations may be unfounded, the absence of verification measures removes a key tool for deescalating conflict. This project aimed to assess the current state of verification technology, in relation to the 21 verification measures evaluated by the VEREX working group between 1995 and 2001, and produced a report describing the difference in the acceptability and feasibility of these verification measures in light of both US concerns over information privacy and technological advances.

List of collaborators and partners

Interviewees included officials and biosecurity experts from the Office of Biological Threat Reduction, U.S. Department of State; the National Center for Medical Intelligence; RAND; ARPA-H; the FBI; the Defense Threat Reduction Agency; the BioWatch program at the Department of Homeland Security; the Belfer Center for Science and International Affairs; and the Federation of American Scientists

Summary of research findings

Interviewees identified technologies that have improved greatly since the VEREX proposal, which are summarized below:

Capability	***1990s***	***Present day***
Remote Sensing	Limited to satellite imagery with low resolution and few spectral bands	High-res commercial satellites, hyperspectral imaging, real-time data streams
AI and machine learning	Nascent; mainly rule-based systems	Advanced pattern recognition, anomaly detection, integration with multi-source data

Biosurveillance	Manual disease tracking, paper records	Global real-time health data networks (e.g., ProMED, GISAID), predictive modeling
Blockchain for traceability	Non-existent	Potential for secure supply chain monitoring of dual-use materials
Cloud computing, big data	Inaccessible at scale	High-throughput analysis of genomic, environmental, and trade data
Synthetic biology	Early-stage gene sequencing	Cheap, rapid DNA synthesis and editing; concerns over dual-use misuse

There are several policy implications of the evolution of verification technologies, including

- **Transparency vs. Secrecy**: New technologies can increase transparency, but governments and private firms may resist surveillance of sensitive facilities.
- **Dual-Use Dilemma**: AI and synthetic biology tools blur the line between legitimate research and nefarious applications.
- **Data Sovereignty**: International data-sharing for biosurveillance is hindered by national laws and privacy concerns.
- **Norm-Building**: Even if a formal verification regime remains politically unviable, tech can support norm development and confidence-building measures.
- **Verification-by-Detection**: Passive, tech-based monitoring may become an accepted proxy for formal inspections.

Implications for study and practice of conflict transformation

This research addresses a key challenge in conflict resolution: how to prevent and manage conflict through arms control and verification mechanisms. While traditional arms control focuses on state behavior and treaties, the BWC's lack of verification has left a normative vacuum. Exploring technology-enabled verification helps advance Confidence-building measures (CBMs), through which tech-based monitoring can foster mutual trust without requiring intrusive inspections. Technological verification also helps norm internalization; tools that encourage transparency and accountability promote compliance even in the absence of enforcement mechanisms.

Conflict resolution is not only about resolving active disputes—it also involves preventing conflict before it starts. Biosurveillance, AI-driven anomaly detection, and early outbreak tracking contribute to early warning systems that can detect suspicious patterns in disease outbreaks or lab activity, and preventive diplomacy by alerting international actors to potential violations or emerging threats. These tools operationalize the concept of proactive peacebuilding—intervening before tensions evolve into security crises. Biological risks often arise in spaces where state and non-state actors overlap (e.g., academic research labs, private biotech firms). This research sheds light on how technology can mediate verification responsibilities between governments and private actors, and the potential for collaborative governance frameworks, where NGOs, firms, and governments share data and oversight responsibilities. Traditional verification is often adversarial: one party inspects another. But tech-enabled verification can support continuous, decentralized information sharing, reframing verification as a form of dialogue rather than surveillance, and shared epistemologies, where conflicting parties interpret signals through common standards and analytic tools. This reframing echoes transformative conflict resolution approaches, which aim to reshape relationships and perceptions rather than just enforce compliance.

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List of publications, performances, media coverage, and other output

Results of this work were presented at the March 2025 Gordon Conference on Chemical and Biological Defense and will be presented as part of a panel at the April 2025 Stanford Existential Risks Symposium. A manuscript of the results was submitted to the special issue “the BWC at 50” of the journal Health Security.