ADVANCED DISEASE OUTBREAKS SIMULATION CAPABILITIES
Request For Information (RFI) – DARPA-SN-25-72
Responses due June 23, 2025, 4:00 PM ET
POC: Rob Saperstein, Ph.D., DARPA/BTO, E-mail: DARPA-SN-25-72@darpa.mil
URL: https://www.darpa.mil/work-with-us/opportunities

The emergence of natural or a man-made infectious agents pose a significant threat to the homeland and to deployed warfighters globally. It is imperative that (bio)technology innovation is efficiently and effectively directed to address, mitigate, and deter the impact of any biological agent. A critical resource in this effort is the development of accurate tunable models and simulation toolsets. While sophisticated epidemiological modeling approaches have been developed, gaps in technical capabilities still exist to be able to exquisitely model disease, transmission, and end-stage health effects within and between individuals at the person-to-person, local, regional, and global levels comprehensively. To defend against emerging and unknown threats, we need advanced capabilities that drive technical innovation and identify critical gaps in biosurveillance, diagnostics, and medical countermeasures.

DARPA is seeking information regarding state-of-the-art capabilities in the simulation of disease outbreaks. We are exploring innovative solutions to enhance our understanding of outbreak dynamics and to improve preparedness for future public health emergencies. We encourage responses from a diverse range of experts including academic, industry, commercial, and start-up communities offering unique solutions to best contextualize how diseases spread between individuals, communities, and geographies and how early intervention can minimize the spread and negative impact through minimizing disease.

We are committed to developing advanced modeling capabilities to optimize response strategies and inform the next generation of (bio)technology innovations to protect the population from biological threats. We are particularly focused on understanding the complex interplay of factors that drive outbreak spread and evaluating the effectiveness of potential interventions.

Information Requested

We are interested in a comprehensive overview of current and emerging technologies for disease outbreak simulation, how simulation approaches could be extended beyond standard modeling methods, and to understand how diseases spread within and between individuals including population level dynamics. Further, identification of optimal timelines and capabilities to detect, identify, attribute, and respond to disease outbreaks, including but not limited to biosensor density deployment achieving optimal detection timelines, are of interest. Please provide responses to the following questions, to the extent possible, with a focus on innovative approaches and demonstrable capabilities. Response to only a subset of the below questions will be accepted, but responders should attempt to be as comprehensive as possible in order to best identify and characterize current and/or proposed future capabilities.

Core Modeling Capabilities

- *Modeling Approaches*: Describe the modeling approaches your organization utilizes (e.g., agent-based models, network models, mechanistic models, hybrid approaches). Please detail the strengths and limitations of each approach, particularly in the context of capturing complex outbreak dynamics.
- *Disease Dynamics***:** How effectively can your models represent key disease characteristics such as mode of transmission, incubation period, infectious period, and the impact of viral evolution or antigenic shift, or unique characteristics of non-replicating disease causing agents? Does your modeling allow for effect associated with multiple co-circulating strains or disparate disease-causing agents?
- *Spatial Modeling***:** Describe your capabilities for modeling the impact of geographical factors, including population density, mobility patterns, and environmental conditions on outbreak spread. What scales do your modeling and simulation approaches best represent and how does modeling accuracy change across scales to recapitulate disease dynamics from individual infection to global spread (person-to-person, local, regional, and global)?
- *Transmission Rate Modeling*: How are transmission rates determined and adjusted within your simulations? Can the models account for superspreading events or variations in transmission based on demographic factors?
- *Fatality Rate & Immune Status*: How are fatality rates and varying levels of population immunity (natural or vaccine-induced) incorporated into your simulations?
- *Intervention Strategies*: Detail the range of intervention strategies that can be modeled, including (but not limited to) vaccination campaigns, social distancing measures, quarantine protocols, treatments, and public health communication strategies. Specifically, describe the ability to model early intervention and its impact on outbreak trajectory.
- *Future Innovation*: Please describe any novel technical approaches – or applications of diverse technical fields (e.g., machine learning, artificial intelligence, complex systems theory, behavioral science) – that you believe would significantly enhance the state-of-the-art capabilities in this field or simulation of biological systems wholistically.

<u>Technical Architecture & Data Integration</u>

- *Software/Platform*: What software and/or platform are your simulation tools built on? Is it open-source or proprietary?
- *Programming Languages & Technologies*: What programming languages, libraries, and technologies are used in the development and execution of your simulations?
- *Computational Requirements*: What computational resources are required to run your simulations (e.g., CPU, GPU, memory, storage)? How fast can comprehensive modeling solutions be completed (time-to-answer; number of iterations per unit time).
- *Scalability & Performance*: How well do your simulations scale to large populations and expansive geographic areas? What performance optimization techniques are employed?
- *Data Integration*: Describe your capabilities for integrating diverse data sources, including (but not limited to) demographic data, mobility data, epidemiological data, healthcare utilization data, and genomic data. What data formats are supported?

- *Validation & Verification (V&V)*: Describe your validation and verification processes. What data sources and metrics are used to assess model accuracy and reliability? Please describe approaches as it relates to science-based V&V exercises vs. in silico solutions (e.g. train/test batch analysis, leave-one-out types of methods, etc.)

Organization Expertise & Experience

- *Relevant Experience*: If any, please provide a concise overview of your organization's experience in disease outbreak simulation, including examples of past projects and clients (if permissible).
- *Team Expertise*: Detail the expertise of your team in areas such as epidemiology, modeling, computer science, data science, and public health.
- *Innovation & Future Development*: Describe any ongoing research and development efforts aimed at improving disease outbreak simulation capabilities. What novel approaches are you exploring?

Potential Collaboration, Opportunities, & Cost (Optional)

- *Collaboration Opportunities*: Are you open to collaborative research and development projects?
- *Potential Opportunities*:
    - Information related to innovation and/or other research and development (R&D) efforts directed towards developing, validating, and running innovative modeling and simulation capabilities are of interest to the DARPA BTO. Please be comprehensive in your response into the types of modeling capabilities, the expected improvements in accuracy and performance, and areas of likely limitations.
    - Existing commercial off the shelf (COTS) and Governmental off the shelf (GOTS) capabilities that would require licensing for use are also of interest. Details of current capabilities, accuracy, computational requirements, running dynamics (e.g. time-to-readout) should be detailed as well as current areas of known limitations or areas that current capabilities were not developed to address.
- *Cost Estimate*: Please provide a cost estimate for developing, licensing, and/or running simulation capabilities as defined by the proposed solution.
    - Cost estimates should assume the end-stage use of a software platform with a user-friendly dashboard able to be used by a range of non-epidemiologist technical experts. Use should be expected to include ability to quickly and efficiently tune key parameters of the model and run multiple simulations to understand the effects of agent characteristics as well as the effects of medical countermeasure (MCM) deployment (for example: efficacy, time of MCM deployment, rate of MCM deployment, time to MCM effect/benefit (not a comprehensive list]).

Format

Respondents to this RFI are encouraged to be as succinct as possible, while also providing actionable insight. Page limits for each section are indicated below. Format specifications for responses include 12-point font, single-spaced, single-sided, 8.5 by 11-inch paper, with 1-inch margins in MS Word or Adobe PDF format.

To the maximum extent possible, respondents are encouraged to send non-proprietary information; if proprietary information is included, respondents are responsible for clearly identifying such information. Responses containing proprietary information must have each page containing such information clearly marked with a label such as "Proprietary" or "Company Proprietary." Do not use "CONFIDENTIAL" as this term indicates classified national security information. DO NOT INCLUDE ANY CLASSIFIED INFORMATION IN THE RFI RESPONSE.

A. Cover Sheet (1 page): Provide the following information.
    a. Response Title,
    b. Core Modeling technical point of contact name, organization, telephone number, and email address,
    c. Technical Architecture technical point of contact name, organization, telephone number, and email address (if different than A.b).
B. Technical Description: At least 1 page, 5-7 pages preferred, 15 page maximum.
C. Bibliography (not to exceed 2 pages): All references must be cited in the Technical Description.
D. References (no page limit): Respondents should include copies in PDF format of *all* cited papers or reports, in sequential order as listed in the Bibliography, combined into one file. Respondents are encouraged, though not required, to highlight sections, figures or statements directly relevant to their technical proposition.

Submission

All technical and administrative correspondence, questions regarding this announcement, how to respond to this RFI, and submissions themselves should be sent to DARPA-SN-25-72@darpa.mil Please refer to **Disease Outbreak Simulation RFI** in all correspondence. Emails sent directly to the Program Manager may result in a delayed response or no response.

Disclaimers and Important Notes

This is an RFI issued solely for information and new program planning purposes; it does not constitute a formal solicitation for proposals. In accordance with FAR 15.201(e), responses to this notice are not offers and cannot be accepted by the Government to form a binding contract. Submission is voluntary and is not required to propose to a subsequent Broad Agency Announcement (BAA) (if any) or other research solicitation (if any) on this topic. DARPA will NOT provide reimbursement for costs incurred in responding to this RFI. NO CLASSIFIED INFORMATION SHOULD BE INCLUDED IN THE RFI RESPONSE. It is the submitter's responsibility to clearly define to the Government what is considered proprietary data. Any proprietary information should be clearly labeled as "proprietary." DARPA will disclose submission contents only for the purpose of review and evaluation. Respondents are advised that DARPA is under no obligation to acknowledge receipt of the information received or provide feedback to respondents with respect to any information submitted under this RFI.