

Federal Register Notice: 89 FR 51554, [Federal Register :: Networking and Information Technology Research and Development Request for Information on Digital Twins Research and Development](#), June 18, 2024.

## **Request for Information on the National Digital Twins R&D Strategic Plan**

DoD Blast Injury Research Coordinating Office (BIRCO)

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Department of Defense Blast Injury Research Coordinating Office response to:

## The National Science Foundation Networking and Information Technology Research and Development Request for Information on Digital Twins Research and Development

We greatly appreciate the opportunity to reply to the Networking and Information Technology Research and Development Request for Information (RFI) on Digital Twins Research and Development Request for Information. Since 2014, the Blast Injury Research Coordinating and Development Office (BIRCO) has been working toward the development of human digital twins to understand and mitigate lethality, injury, and impairment from blast hazards. We have been leading cross-organizational Working Groups to achieve this goal both within the US Government and with our NATO partners. These engagements have resulted in the development of many research and development (R&D) topics that have relevance to the RFI that are discussed below.

**Data:** Two significant challenges faced by the biomedical community in establishing human digital twins are a) access to industrial, academic, and Government data sources and 2) robust understanding of the quality of these data. Providing appropriate access, minimizing burden on the host site, and maintaining intellectual property controls were challenges discussed across our domestic and international engagements. Data quality varies widely and methods for effective methodological reporting are inconsistent. A more robust and consistent way to provide end-users of the data with an understanding of its limitations is necessary.

**VVUQ:** The ability for models to effectively and correctly communicate is necessary in the development of a human digital twin due to the complexities of different body systems and spatial and temporal changes biological responses. Conceptual alignment of the models and associated simulations is necessary to support the creation of the integrated system of simulations with correctly aligned data and orchestrated processes. Trust in the model between modelers and stakeholders, which can be built on effective validation, is critical for credibility and acceptance of outputs from a Digital Twin. Unfortunately, human body computational models are not generally designed to be integrated within a digital twin or even exchange data. Concepts that are explicitly defined or assumed within one model may be absent or assumed incapable with another model challenging the ability to use these models within the same simulation environment. Model validation is complex and varied and models of interest are likely not to be validated in all relevant environments or for all injuries of interest. Research into appropriate model extrapolation as part of VVUQ beyond its original intended use would be of significant interest within the Strategic Plan.



**Ecosystem and International:** The DoD Working Group on Computational Modeling of Human Lethality, Injury, and Impairment from Blast-Related Threats (CMWG) established by BIRCO garnered support from 26 DoD organizations and 7 other federal agencies including NSF. The NATO Human Factors and Medicine (HFM) Research Technical Groups (RTGs) chaired by BIRCO were supported by 13 NATO nations. Establishing and sustaining these communities required appropriate alignment of interests and consensus building to give all parties a voice.

Extending from these engagements, development of a human digital twin requires successful coordination and resourcing from across the federal Government as well as international partners. An appropriate governance structure that gives all parties a stake in the results will help to establish a lasting eco-system. A collaborative governance structure promotes collective decision-making in situations where one or more public agencies directly engage non-governmental stakeholders in a formal, consensus-oriented, and deliberative decision-making process aimed at making or implementing public policy and/or managing public programs or assets. Research into understanding how to establish and sustain a collaborative governance structure would greatly enhance the Strategic Plan. Lessons learned from the BIRCO domestic and international engagements may prove beneficial in the Strategic Plan's development.

### References and Resources

- Byrne, R., Davis, N., Gupta, R., Santago, A., II, and Tolk, A., “Developing a Blast Injury Modeling Capability: Application of Concepts from the Defense M&S Domain” J. Def. Model. Simul. <https://doi.org/10.1177/15485129231184258>
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- STRATEGIC PLAN FOR THE DEVELOPMENT OF A DOD HUMAN BODY COMPUTATIONAL MODELING CAPABILITY;” “DoD Working Group on Computational Modeling of Human Lethality, Injury, and Impairment from Blast-Related Threats” Aug 2022. (accessible to US Government officials via request to BIRCO)
- “IMPLEMENTATION PLAN FOR THE DEVELOPMENT OF A DOD HUMAN BODY COMPUTATIONAL MODELING CAPABILITY;” DoD Working Group on Computational Modeling of Human Lethality, Injury, and Impairment from Blast-Related Threats. July 2024 (accessible to US Government officials via request to BIRCO)
- <https://blastinjuryresearch.health.mil/>



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