**Human Body Computational Modeling Questionnaire for the**

**Human Body Computational Modeling Registry:**

**DoD Working Group on Computational Modeling of Human Lethality, Injury, and Impairment from Blast-related Threats**

The purpose of this Working Group is to shape, focus, and coordinate the DoD's computational modeling efforts to enable a new DoD capability for modeling and simulation of human lethality, injury, and impairment from the entire spectrum of blast-related threats and environments. These blast threats include the full blast injury taxonomy consisting of primary (initial pressure wave), secondary (penetrating ballistic), tertiary (blunt impact), quaternary (burns & toxic gasses) and quinary (illness from biological/chemical/radiologic substances) (see DoDD 6025.21E for more information).

The development of the desired DoD Modeling Capability (Modeling Capability) will be supported by the creation of a living Human Body Computational Modeling Registry (Modeling Registry). Providing information on your organization’s computational model(s), including models beyond those that directly predict lethality, injury, and impairment, from a blast-related threat (such as those modeling the recovery of those effects) is essential for creating a comprehensive Modeling Registry. This Human Body Computational Modeling Questionnaire (Modeling Questionnaire) is intended to capture information needed to understand the state of the science in computational modeling and is organized in to three sections:

1. Administrative and Organizational Aspects
2. Conceptual Aspects
3. Implementation Aspects

Responses to the Modeling Questionnaire will be used to create a Modeling Registry, storing pertinent information about models aligning to the Modeling Capability. This Modeling Registry will be available for WG members to query information on available computational models to identify computational models for solving problems associated with blast-related injury, lethality and impairment from the point of interaction with the blast hazard to return to routine. The Modeling Registry allows the WG to view the information collected on computational models and determine applicability to their organization’s research and development goals. The Modeling Registry will accommodate updates to information in the registry and adding information about new models as they are identified.

Please complete the Modeling Questionnaire for **each** computational model developed within your organization. If you employ a series of computational models within a common experimental framework, please document the computational models separately. For consideration, this Modeling Questionnaire contains 51 questions and should take about 1 hour to complete per model.

Thank you for your efforts on this initiative.

For clarity and reference, below are **terms** used within the context of the Modeling Questionnaire:

***Computational Model:*** *The numerical implementation of a conceptual model including all mathematical, numerical, logical and qualitative representations and consisting of well-defined procedures, solution algorithms and convergence criteria.*

***Computer Simulation:*** *The imitation of the characteristics of a system, entity, phenomenon, or process using a computational model executing over a duration of time.*

***Experimental Framework:*** *An**organized structure of computational models designed to capture all input/output parameters and share information between computational models.*

***Federation:*** *A named set of interacting federates, a common federation object model, and supporting infrastructure that are used as a whole to achieve a specific objective (not inclusive to IEEE 1516).*

***Impairment:*** *The computational model output expressive of impairment to the Warfighter.*

***Injury:*** *The computational* *model output expressive of injury to the Warfighter.*

***Infrastructure:*** *Supporting software and documentation (data limitations, error analysis, etc.), data, and inputs required to properly execute a computational* *model.*

***Lethality:*** *The computational* *model output expressive of lethality to the Warfighter.*

***Long-Term Health Effects:*** *The computational model output expressive of chronic impairment.*

***Owner:*** *An individual or controlling agency which currently possesses data rights to a computational model for modification and/or distribution.*

***Computer Simulation Architecture:*** *The computer simulation software or code structure within a computational* *model.*

***Computer Simulation Interoperability Standard:*** *An accepted specification allowing for the communication of data between computational models.*

***Validation:*** *The process of determining the degree to which the computational* *model and associated data are accurate representations of the real world from the perspective of the intended use(s).*

***Verification:*** *The process of determining that a computational* *model and associated data accurately represent the developer’s conceptual description, specifications, mathematical model, and solution.*

**I: Administrative and Organizational Aspects:**

1. Do you have an existing computational model that predicts some aspect of human lethality, injury, impairment, or long-term health effects?

[ ]  Yes

[ ]  No (Stop the Modeling Questionnaire)

1. What is the name of the computational model? Please spell out acronyms.

Click or tap here to enter text.

1. Who was the Principal Investigator (initial developer) for the development of the computational model? Please include full name and contact information.

Click or tap here to enter text.

1. Who is the current Owner/Controlling Agency of the computational model?

Click or tap here to enter text.

1. Do you know of any current users of the computational model?

[ ]  No

[ ]  Yes (Please provide full name(s) and contact information)

Click or tap here to enter text.

1. Are there any publications or historical uses that can be reported?

[ ]  No

[ ]  Yes (Please provide those references)

Click or tap here to enter text.

1. Where is the source code for the computational model housed? Please describe any access limitations or constraints.

Click or tap here to enter text.

1. Is there a configuration management process being followed for the computational model?

[ ]  No

[ ]  Yes (Please provide current version number)

Click or tap here to enter text.

1. Is your computational model fully developed (correct output in current version)?

[ ]  Yes

[ ]  No

If no, at which stage of development is the model currently?

[ ]  Prototype

[ ]  Being Proven Out

[ ]  Interim Design

[ ]  Validation & Verification

1. Is the computational model being actively updated and maintained?

[ ]  No

[ ]  Yes

1. What, if any, additional effort is needed to fully develop the computational model?

Click or tap here to enter text.

1. What is the solving software or computer simulation architecture (LS-DYNA, Abaqus, Velodyne, OpenSim, etc.) used for the computational model? Please list the specific versions of any required software.

Click or tap here to enter text.

1. Does the computational model utilize an integrated or modular modeling architecture?

[ ]  Integrated

[ ]  Modular

1. Is there a license fee associated with the computational model’s use?

[ ]  No

[ ]  Yes (Describe the fee structure (one time, annually, etc.)

Click or tap here to enter text.

1. (a) Are additional software tools/capabilities, such as databases, visualization software, numerical solvers, etc., needed to run the computational model?

[ ]  No (please proceed to Question #16)

[ ]  Yes

(b) What are additional costs associated with these systems?

Click or tap here to enter text.

1. What level of commitment (time/resources/data preprocessing) is required to set up these systems?

Click or tap here to enter text.

1. Does the computational model support debugging components during run time execution?

[ ]  No

[ ]  Yes

1. Is the computational model operating system (OS) specific?

[ ]  No

[ ]  Yes (Please specify OS)

Click or tap here to enter text.

1. Can the computational model be installed and run on other systems?

[ ]  No

[ ]  Yes

1. Does the computational model require parallel computing?

[ ]  No

[ ]  Yes (Indicate if High Performance Computing Clusters are optional or required)

Click or tap here to enter text.

1. What are the minimum/optimal hardware requirements to run the computational model?

Click or tap here to enter text.

1. Has your computational model been validated? Check all that apply.

[ ]  No

[ ]  Yes, by user acceptance tests based on requirements

[ ]  Yes, by comparison of the behavior of the computational model with the behavior of the real-world referent

[ ]  Yes, by subject matter experts validating that the computational model reflects current theory correctly

[ ]  Yes, by inspection of results by subject matter experts

[ ]  Yes, other (specify):

Click or tap here to enter text.

1. What data were used to validate the computational model?

Click or tap here to enter text.

1. Is the verification and validation process documented, and is the documentation accessible?

[ ]  No

[ ]  Yes (Please provide any published references)

Click or tap here to enter text.

1. Has the computational model been accredited?

[ ]  No

[ ]  Yes (Describe by whom and for what purpose)

Click or tap here to enter text.

**II: Conceptual Aspects of the Computational Model:**

1. What is the intended use and/or context of use for the computational model?

Click or tap here to enter text.

1. How are assumptions and constraints for the computational model captured?

[ ]  Documentation / User Guide of the computational model

[ ]  Experimentation frame (allows for runtime check)

[ ]  None

[ ]  Other (specify):

Click or tap here to enter text.

1. How did/does the principal investigator assess the strengths/weaknesses of the computational model (i.e., sensitivity analyses, uncertainty analyses, CORA, error propagation analysis)?

Click or tap here to enter text.

1. What limitations does the computational model have (i.e. data assumptions/restrictions, material property assumptions, physical properties assumptions, validation/verification)?

Click or tap here to enter text.

1. Please briefly describe what tasks need to be accomplished to overcome these limitations.

Click or tap here to enter text.

1. Can your computational modeling capability be integrated/combined with other tools to increase effectiveness?

[ ]  No

[ ]  Yes (Please explain)

Click or tap here to enter text.

1. (a) What assumptions are made in developing the computational model concerning threat, materials, boundaries/interfaces, or injury criteria?

Click or tap here to enter text.

(b) Have the assumptions been captured in a user guide that is accessible?

[ ]  No

[ ]  Yes

1. Is the computational model based on deterministic or probabilistic (stochastic) concepts?

Click or tap here to enter text.

1. What is the source of the geometry used in the computational model (i.e., Atlas, CT/MRI, anthropomorphic database, etc.)?

Click or tap here to enter text.

1. What are the sources of data used to create your computational model? Please provide any published references.

Click or tap here to enter text.

1. What are the supporting material models/properties needed to run the computational model? Please provide any published references.

Click or tap here to enter text.

1. What input data (type, format, units) are required to run the computational model?

Click or tap here to enter text.

1. (a) Is the input data readily available or must it be acquired experimentally by the user?

[ ]  Readily available (please answer only (b) below)

[ ]  Experimentally acquired (please answer only (c) below)

(b) Are quality assurance procedures used while collecting the data?

Click or tap here to enter text.

(c) Do you require a specific device for input data acquisition?

Click or tap here to enter text.

1. What blast threat threat/loading mechanism does the computational model address? Check all that apply.

[ ]  Primary (initial pressure wave)

[ ]  Secondary (penetrating ballistic)

[ ]  Tertiary (blunt impact)

[ ]  Quaternary (burns and toxic gases)

[ ]  Quinary (illness from biological/chemical/radiological substances)

[ ]  N/A (specify):

Click or tap here to enter text.

1. How long after the insult does the computational model predict the outcome? Please specify in seconds, minutes, hours, days, months, and/or years.

Click or tap here to enter text.

1. What is the output (prediction) of the computational model (e.g. loss of consciousness, lung contusion, fractures, sprains, tissue rupture, functional degradation, burn area, degradation of cognitive function, etc.)?

Click or tap here to enter text.

1. What is the spatial resolution of the computational model (subcellular, cells, organ level, system level, etc.)? Check all that apply.

[ ]  Subcellular

[ ]  Cellular

[ ]  Organ/tissue

[ ]  System level

[ ]  Body part

[ ]  Whole body

[ ]  Populational

[ ]  Other (specify)

Click or tap here to enter text.

1. Does the computational model address the modifying effect of the human’s:

[ ]  Anthropomorphology

[ ]  Posture

[ ]  Sex
[ ]  Race

[ ]  Age

[ ]  Pre-existing conditions

[ ]  Personal Protective Equipment

[ ]  Other (specify)

 Click or tap here to enter text.

1. What parameters (i.e. stress, strain, strain energy, etc.) correlate with the biological/physiological effect that the computational model predicts?

Click or tap here to enter text.

**III: Implementation Aspects of the Computer Simulation:**

1. What are practical limitations (software run time, accessibility for use, etc.) associated with the computer simulation?

Click or tap here to enter text.

1. What is the basic type of the computer simulation? Check all that apply.

[ ]  Finite Element

[ ]  Computational Fluid Dynamics

[ ]  Rigid Body

[ ]  Equations of Motion (kinematic)

[ ]  Multibody Dynamics

[ ]  AI/Deep Learning Techniques

[ ]  Other (specify)

Click or tap here to enter text.

1. How does the computer simulation execute?

[ ]  In real time (e.g. prediction of heart rate for surgical simulations)

[ ]  Faster than real time (e.g. prediction of long term bone regeneration)

[ ]  Slower than real time (e.g. prediction of injuries from underbody blast)

1. Is the computer simulation designed to be federated with other computational models to be executed within such a federation?

[ ]  No

[ ]  Yes (Please explain)

Click or tap here to enter text.

1. Does your computer simulation support a computer simulation interoperability standard?

[ ]  No

[ ]  Yes (Please list which ones)

Click or tap here to enter text.

1. Does the computer simulation use a standardized data format for input and output data?

[ ]  XML

[ ]  JASON

[ ]  BSON

[ ]  SQL-like database

[ ]  RESTful database/mongo

[ ]  ASCII

[ ]  Other (specify)

 Click or tap here to enter text.

1. Is the computer simulation supported by an infrastructure that allows automated design, execution, and evaluation of experiments?

[ ]  No

[ ]  Yes (Please provide details of any published references)

Click or tap here to enter text.

1. (a) What level of user expertise is necessary to execute the computer simulation?

Click or tap here to enter text.

(b) What training is available?

Click or tap here to enter text.

**Thank you** for completing this Modeling Questionnaire. Your feedback is greatly appreciated.