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RESEARCH
AND ENGINEERING

MEMORANDUM FOR CHAIRMAN, DEFENSE SCIENCE BOARD

SUBJECT: Terms of Reference - Defense Science Board Task Force on Gaming, Exercising, Modeling and Simulation

The global threat environment is stressing the Department of Defense (DoD) across all warfighting domains. Emerging existential threats demand attention; threats from terrorism persist, requiring global situational awareness; anti-access/area-denial challenges are growing; adversaries confront the U.S. with gray zone actions; and the U.S. homeland is no longer a sanctuary. This environment demands greater speed and agility across the spectrum from structuring and equipping to deploying and sustaining military forces. These growing demands amplify the need for rapid—but informed—decision-making.

Gaming, exercising, modeling, and simulation (GEMS) are all tools that complement the human mind when addressing complex tasks. Adept use promotes an empirical approach to solving problems by enabling decisions based on the a priori determined "right" bases and on evidence, not on the basis of rank, past history, or cultural bias. Increasingly, models and simulations (M&S) have become part of a larger system of people plus hardware plus software in which they play a part that either was not present in the past, or was performed by people. Such tools have matured in effectiveness over the past half century and increasingly employ machine learning algorithms, which offer substantial benefits in dealing with complexity while at the same time making traditional validation and verification techniques obsolete.

GEMS are not new to DoD. The military led in developing M&S to support the exercise of multiple people and to explore trade-space in acquisition programs. Games are used to explore operational concepts as well as to train Warfighters. DoD has established policy and implementation guidance addressing both the management and the verification, validation, and accreditation of these tools.[1]

The objective of the Task Force on GEMS is to review DoD's current state of practice in the use of GEMS and will make recommendations that enable better decisions and choices—accomplished with greater speed and agility. Recommendations will address informed decision-making across a spectrum of activities including:

- Evaluation of complex choice tradeoffs (e.g., acquisition planning, including upgrade/re-purpose options); weapons mix planning; cost estimation;
- Exercise coping with complex, incrementally unfolding scenarios; training teams to work together (including man-machine teams);
- Cueing (augmenting an operational system with a model that analyzes and isolates promising "signal in noise" so that humans can focus on what is most relevant);

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[1] Department of Defense Directive #5000.59: DoD Modeling and Simulation (M&S) Management; Department of Defense Directive #5000.61: DoD Modeling and Simulation (M&S) Verification, Validation, and Accreditation (VV&A); Department of Defense Instruction #5000.70: Management of DoD Modeling and Simulation (M&S) Activities.

- Training and evaluation of autonomous algorithms, and learning algorithms, across diverse applications and operational scenarios;
- Exercise to learn manual and mental skills (e.g., learning to distinguish and identify sounds from a submarine sonar sensor or learning to negotiate with a tribal village elder in the Middle East).

The Task Force will review the implementation of DoD policy and guidance for both management and validation of GEMS to identify gaps, barriers, and opportunities for improvement. Particular emphasis will be placed on techniques for promoting visibility and accessibility of cross-cutting tools, data, and services; and on validation and verification techniques for learning algorithms.

The Task Force will also review the state of practice in the use of GEMS in relevant private sector analogs and across the Government-affiliated laboratory community. Opportunities will be identified for DoD to adopt/adapt capabilities and/or practices to accelerate its use of GEMS to increase speed, agility, and informed decision-making across its enterprise.

I will sponsor the study. Dr. Ruth David and William LaPlante will serve as the co-Chairmen of this study. Mr. Leigh Yu will serve as the Executive Secretary. Mr. David Moreau will serve as the Defense Science Board Secretariat representative.

The Task Force members are granted access to those DoD officials and data necessary for the appropriate conduct of their study. The Under Secretary of Defense for Research and Engineering will serve as the DoD decision-maker for the matter under consideration and will coordinate decision-making as appropriate with other stakeholders identified by the study's findings and recommendations. The nominal start date of the study period will be within 3 months of signing this Terms of Reference, and the study period will be between 9 to 12 months. The final report will be completed within three months from the end of the study period. Extensions for unforeseen circumstances will be handled accordingly.

The study will operate in accordance with the provisions of Public Law 92-463, "Federal Advisory Committee Act," and DoD Instruction 5105.04, "DoD Federal Advisory Committee Management Program." It is not anticipated that this study will need to go into any "particular matters" within the meaning of title 18, United States Code, section 208, nor will it cause any member to be placed in the position of action as a procurement official.

Michael D. Griffin