

**FY21 - Modeling and Simulation Program**  
**Absolute Priority 1 – Enhancing Grants**

**P116S210003** – Old Dominion University, VA

**Project Title:** GROW M&S: Enhancing Graduate Research Opportunities and Workforce Readiness in Modeling and Simulation

**Abstract:**

The Virginia Modeling, Analysis and Simulation Center (VMASC), in partnership with Old Dominion University and modeling and simulation industry collaborators, will lead the Graduate Research Opportunities and Workforce Readiness in Modeling and Simulation (GROW M&S) project. The central aim of this project is to develop and implement equity-minded, innovative research opportunities to improve transferrable skills, career pathways, and workforce trajectories for underrepresented and underserved graduate students in M&S.

The proposed project design will be implemented across all 7 Old Dominion University academic colleges and departments in Norfolk, Virginia. The project will expand multidisciplinary M&S higher education programs providing novel M&S research experiences for graduate students (Absolute Priority 1 Enhancing M&S at institutions of higher education by A) Expanding the multidisciplinary nature of M&S programs, B) Recruiting diverse students through assistantships, D) Conducting research to support new methodologies and techniques in M&S). The proposed programmatic activities are anchored in three priorities: 1) expanding M&S multidisciplinary research opportunities for graduate students, 2) enhancing transferrable academic and professional skill sets, and 3) enhancing strategic collaborations across M&S academia and industry partners through a learning ecosystem. Priorities will be addressed through direct engagement with ODU-VMASC research faculty conducting M&S research, workforce readiness workshops, paid summer internships with M&S industry partners, and submissions of research papers and presentations to conferences/publications. Through successful iterations and refinements of resources and content, this model can be generalized for replication across higher education institutions conducting innovative research with students.

**P116S210005** – University of Iowa, IA

**Project Title:** Artificial Intelligence, Modeling and Simulation (AIMS) Certificate Programs

**Abstract:**

Artificial intelligence (AI) is a technology that mimics human intelligence to solve complex problems and perform complex tasks. Machine learning (ML) is a subfield of AI that uses statistical methods to learn from data without being explicitly programmed. Deep learning (DL) is a main subset of ML that uses multi-layered neural networks to learn from data. Modeling and simulation (M&S) in engineering is a field that uses mathematical models as a basis for simulations to generate data analyzed for product and system design. M&S is a knowledge-based approach that develops models to generate data, while ML is a data-based approach that learns from data to generate models. We use AI in the program title to emphasize: (1) the importance of uncertainty quantification (UQ) in all methods, (2) the various types of combinations: M&S-

assisted ML, ML-assisted M&S, and hybrid approaches with a strong mutual interplay, and (3) the notion of using multiple models as multi-omics in biology toward the design of intelligent complex machines.

**Target Population:** This project targets about 30-40 undergraduate students from our established Design focus area and approximately 50 graduate students. **b. Services and Proposed Activities:** The proposed work consists of seven aims. Aims 1 and 2 involve literature reviews of AI/ML and UQ methods, whereas Aim 3 is to conduct research on new methods. Aims 1, 2 and 3 will enable development of new courses and revamping of existing courses. Aim 4 engages students in problem-solving through learning and interacting with peers outside of their cohort through participation in workshops and events, including HACKUIOWA presented by University of Iowa Hydroinformatics Lab. Aim 5 enhances the Design focus area for Mechanical Engineering students and creates the two new AIMS certificate programs for undergraduates and graduate students. Aim 6 centers on student recruitment into the AIMS programs as well as our undergraduate-to-graduate (U2G) accelerated program and our undergraduate-to-PhD (U2PhD) program through the use of scholarships and assistantships. We will particularly focus on diversifying the student body and creating an equitable and inclusive community. In Aim 7, we will conduct outcome assessment (project evaluation) by tracking the progress of different cohorts of students. Finally, we will participate in annual task force meetings in Washington DC and disseminate our results through attendance at major professional conferences and publication in peer-reviewed journals.

**Anticipated Results:** The proposed work will result in the creation of new undergraduate and graduate AIMS certificate programs that prepare students with new modeling strategies bringing together independent approaches from the fields of artificial intelligence and modeling and simulation to bridge the knowledge gap between them and take advantage of respective approaches, allowing for design of complex products and systems.

## **P116S210001 – The University of Central Florida Board of Trustees, FL**

**Project Title:** Enhancing the Impact of Modeling and Simulation Education for the 21st Century Workforce

### **Abstract:**

**Target Population.** Graduate and undergraduate students in modeling and simulation (M&S) program at the University of Central Florida (UCF), and military, business, industry, academia, and K-12 partners

**Services and Proposed Activities.** (1) Develop and test a new conceptual framework called Meta Digital Twin (MDT); (2) Design and offer graduate- and undergraduate-level courses in modeling and simulation (M&S); (3) Engage, collaborate, and develop a vast network with multiple stakeholders and partners across several sectors to advance our current M&S tools, techniques, and methods to improve our understanding of the human, education, economic, and social issues in dealing with significant societal challenges; (4) Train M&S students to develop, use, and transfer research and analytical skills in collecting and analyzing complex human-machine interaction multimodal data using RAPID, a new stationary, mobile, and virtual lab; (5) Test the effectiveness of a multi-user virtual world platform to enhance M&S training for students, faculty, stakeholders, and partners.

Anticipated Results. (1) Enhanced learning outcomes and workforce preparation of M&S graduate and new undergraduate students with enhanced curriculum; (2) New multi-sector partnerships to test and implement Meta Digital Twin framework; (3) Enhance M&S training by solving societal challenges with RAPID; (4) Delivering enhanced M&S education and training to multiple stakeholders and partners with new virtual M&S campus.