

Modeling and Simulation Program (MSP) Program Fiscal Year 2023 Summary of Funding

- **FY 2023 Appropriation:** \$8,000,000
- **FY 2023 Amount for New Awards:** 7,920,000
- **Total Amount Funded FY 2023 MSP Competition:** \$7,920,000
- **Number Absolute Priority 2 New Awards:** 4
- **Total Number of FY 2023 MSP New Awards:** 7

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ABSTRACT

Atlantic University College (PR), \$1,154,345, AP 2 - Establishment Grant

Atlantic University College (AUC), a **Hispanic-Serving Institution** located in Guaynabo, Puerto Rico, proposes a Modeling and Simulation Program (MSP) titled “***Modeling and Simulation of Human Interaction and Experience in Virtual and Mechanical Systems.***” The primary goal of the proposed MSP is to design and implement a minor in simulation modeling and four certificates (world creation, immersive simulation, data visualization, and additive manufacturing (3-D printing)) for students who wish to concentrate and develop strong skills in modeling and simulation for various applications. **The project falls under Absolute Priority 2 (Establishing Modeling and Simulation Programs).** In addition to the development of the modeling and simulation minor and professional certificates, it will also provide modeling and simulation courses for non-STEM majors who wish to apply modeling and simulation knowledge in their respective fields.

The proposed MSP initiative has the potential to make a significant impact by enabling the University to contribute towards the education of Hispanic professionals in advanced computing. It can also serve as a motivating factor for future Hispanic scientists and developers, who are currently in high demand. The project aims to establish a culture of research and development within AUC’s existing activities, with the goal of enhancing its areas of expertise, empowering its STEM offerings, aligning skill sets with industry needs, and laying the foundation for specialized knowledge, intellectual property, and commercial collaboration that will sustain the institution. The MSP will have a positive impact on industries such as entertainment, defense, healthcare, education, workforce training, and construction industries. The resulting research can lead to the creation of new databases and solutions, which can further advance and innovate these industries.

The Project will also contribute to an increase in modeling and simulation literacy in society at large. By raising awareness of the significance of simulation and modeling, it will help students and the general public understand how these technologies can be applied to solve real-world problems. The MSP certificates and degree program will serve as a distinctive contributor to the expansion of the country’s modeling and simulation workforce. This will not only benefit Hispanic students but also the broader community, as the application of these technologies has the potential to revolutionize various industries. The AUC’s Modeling and Simulation Program is poised to equip students with the necessary skills and knowledge to excel in the modeling and simulation industry. By doing so, the program will not only contribute to the growth of the modeling and simulation workforce in the country but also raise awareness about the significance of simulation and modeling in society. Also, the Project aligns well with AUC’s mission and vision, providing a strong foundation for future academic and research initiatives. With this program, AUC is taking a significant step towards shaping the future of the modeling and simulation industry and creating a better tomorrow for all. AUC’s laboratory facilities, including the Visualization Modeling and Simulation Laboratory (ViSiM Lab), the Spatial Computing and Virtual Reality Lab, and the Fabrication and 3D Printing Laboratory (FabLab), will provide comprehensive support for the proposed programs.

Modeling and Simulation at Clark State College
Clark State College (OH), \$1,074,831, AP 2 - Establishment Grant

Abstract

Clark State College proposes the establishment of an associate degree and applied bachelor's degree in Modeling and Simulation. This proposal addresses Absolute Priority 2 - Establishing Modeling and Simulation Programs. This proposal also addresses the Invitational Priority - Promoting Equity in Student Access to Educational Resources and Opportunities, as Clark State College is a community college. The anticipated period of performance is January 1, 2024 to December 31, 2026.

There is a high demand in Clark State's region for modeling and simulation skills. Wright Patterson Air Force Base (WPAFB), which is also home to the Air Force Research Laboratory (AFRL), is partially located within Clark State's service area, and Clark State's Greene Center campus location is about one mile from the base. The region has many existing or incoming high-tech businesses that need modeling and simulation skills. According to data from JobsEQ, there were 2,895 active online job postings for the keywords "modeling and simulation" within a 60-mile radius of Springfield, Ohio, where Clark State's main campus is located. Meeting modeling and simulation needs is crucial to meeting area economic and national defense needs.

This project will result in an innovative, project-based, stackable curriculum for both an associate degree and applied bachelor's degree program, designed with strong employer input. This program will be designed to serve both students new to the field and incumbent workers looking to upskill. Clark State serves many low-income students, with 53% of students receiving a federal Pell grant. Two-thirds of the student population is female, and about 27% identify as a race other than white alone. This positions the associate and bachelor's degree programs at Clark State to be a pathway into a high-paying technical career for low-income students and students who are often underrepresented in technology fields.

ABSTRACT

California State Polytechnic University (CA), \$1,151,082, AP 2 - Establishment Grant

California State Polytechnic University, Pomona (Cal Poly Pomona or CPP) seeks to enhance student education and expand expertise in Industrial 4.0, by establishing a modeling and simulation career-track program titled *Industry 4.0: Career Advancement through Research and Education in Modeling and Simulation* (iCARE-M&S) (MSP Absolute Priority Two). The interdisciplinary nature of iCARE-M&S encourages collaboration among faculty and students from diverse disciplines, enabling the exploration and resolution of complex problems that transcend traditional boundaries.

The **goal** of the proposed program is to increase the pool of STEM professionals and leaders with the knowledge, skills, and experience needed to integrate M&S concepts into Autonomous Systems for students' current and future research, careers, and academic plans. The program will serve students from the CPP College of Engineering and from the Computer Sciences Department. It aims to expedite the education of the students beyond their degree program by providing them with comprehensive M&S training and experience with a specific focus on autonomous (electric) vehicles. Through **Objective One**, faculty will bring isolated M&S courses under the umbrella of the iCARE-M&S facilities and website, by building the overall program structure, upgrading existing M&S courses, creating new ones, and by developing a series of freely accessible online course that encompass a wide range of topics vital for I4.0 careers, including computer vision, autonomous navigation, and cyber security. A digital badging (micro certification) process is a key output. The primary Objective One outcome is the development and delivery of an M&S Career-Track Program in which students can earn badges that represent the successful acquisition of key I4.0 competencies.

In **Objective Two**, current CPP modeling and simulation tools will be upgraded for vehicles that are of higher fidelity than previous test platforms in the CPP M&S facility and which are safe to use. Students and faculty can access the simulation software, to test them on the research platform known as the *Universally Reachable Modeling System for Autonomous Systems* (URM-SAS). This platform is available to CPP faculty and students but is most significant is that students and faculty from local and international universities will also have access to URM-SAS. iCARE-M&S student participants will lead the validation of URM-SAS performed by others, e.g., the international partner (Ganpat University). One important outcome is increased student and faculty access to the CPP M&S Facility, and another is a demonstrated increase in the participants technical M&S knowledge.

In **Objective Three**, participants gain valuable technical knowledge, they explore their M&S career interests, and learn how to work with students and faculty in the CPP M&S Facility. In **Objective Four**, they apply knowledge acquired through Objective Three in the context of the facility thus deepening what they acquire through immersion in their learning. Through workshops and activities such as invited-speaker series, iCARE-M&S participants acquire important professional skills such as communication, teamwork, and leadership and I4.0-specific mindsets such as futuristic thinking, flexibility, and creativity. Participants also lead faculty project teams as part of Objective Four which strengthens both their technical and professional skills.

To ensure use by what we learn through the iCARE-M&S Evaluation Enterprise, we plan to widely disseminate our progress and lessons learned (**Objective Five**). By participating in the proposed program, students will be better prepared for careers related to I4.0 and to pursue further exploration of modeling and simulation in their future research, academic, and career pursuits.

PROJECT ABSTRACT

University of Houston (UH), \$1,074,876, AP 2 - Enhancement Grant

Developing System Modeling and Simulation based Programs at the University of Houston

University of Houston (UH) is responding to the Absolute Priority 2 and Invitational Priority to Minority Serving Institute (IP-MSI). The total amount requested is \$1,139,973.

'Modeling & Simulation' plays a crucial role in the research and development of Industries of the Future (IoT) topics, comprising artificial intelligence (AI), quantum information science (QIS), advanced manufacturing, advanced communications, and biotechnology. It is used to simulate and analyze complex systems, processes, and phenomena in a virtual environment to evaluate existing systems or implement new systems. UH Industrial Engineering (IE), in collaboration with the *teachHOUSTON* (tH) secondary teacher preparation program, proposes to leverage the funding of the Modeling and Simulation Program (MSP) to develop a minor in *IE undergraduate* program, a new track for the *IE graduate* program, and a certificate for *non-IE graduate* students in *Systems Modeling and Simulation* (SMS). The SMS minor in IE is available to all majors at UH.

This project has **four objectives**: 1) adjusting the existing IE curriculum and developing a plan to establish new SMS programs. Two existing courses, Systems Simulation and Data Analytics, will be revised and two new courses on SMS Decision Making and Simulation Applications will be developed; 2) developing an Interdisciplinary Modeling and Simulation (IMS) lab to promote research and outreach; 3) infusing culturally responsive pedagogy (CRP) to integrate the new course and lab activities considering background and individualized needs of minority students, with IE faculty formally trained in CRP; and 4) enhancing student support and career path planning towards SMS, and outreach to K-12 students and teachers through workshops and summer programs. The research team is composed of subject matter experts in modeling and simulation, data science, artificial intelligence, preservice teacher education, culturally responsive pedagogy, and outreach. The evaluator, a professor of human resource development, will assess the project's progress. Through the SMS programs, this project will contribute to the training and education of the modeling and simulation workforce much needed by the IoT.

UH is the ***second most ethnically diverse major research university*** in the United States. It is a Hispanic Serving Institution and Asian American and Native American Pacific Islander Serving Institution with 47,000+ students. UH has been presented with a challenge and an opportunity to create a diversified STEM workforce which reflects the demographics of the city of Houston and the nation. Responding to IP-MSI, the project will leverage CRP to effectively deliver course contents to students from underrepresented groups, including women, racial and ethnic minorities, and persons with disabilities. It will ensure equitable access of female and URM students to the SMS programs, regardless of gender, race, national origin, color, disability, or age. Having a solid knowledge of SMS opens various career opportunities in different industries.

The SMS knowledge will be shared with K-12 students in summer camps organized by the project team members through collaboration with Cullen College of Engineering, tH, and the UTeach STEM Educators Association. The proposed project will positively influence students' learning and career paths, especially those from underserved districts and underrepresented groups. The faculty mentors will report the project progress and results in papers at conferences such as the Institute of Industrial and System Engineers and American Society of Engineering Education annual conferences and journals such as the *Journal of Engineering Education*. The developed course materials will be available for download for free from the project website.