Continuing Education Units: An I/ITSEC Opportunity

Continuing Education Units (CEU) were established in 1970 to create a unit of measurement to quantify continuing education and training activities. CEUs apply to technical and educational settings such as I/ITSEC. The primary focus of I/ITSEC is to highlight innovative implementation of simulation and education technologies as tools to achieve cost efficient training and increased military readiness. Therefore, CEUs are offered for all **Tutorials, Paper Sessions, and the Professional Development Workshops**. CEUs are being sponsored and maintained by the University of Central Florida, Division of Continuing Education.

WHY SHOULD I EARN CEUs AT I/ITSEC?

- Participation in the tutorials, papers and Professional Development Workshops for CEU credit reinforces your commitment to remain current in the evolving technologies relating to training and simulation.
- The CEU transcript indicates your active participation in the technical program of the conference to your employer.
- Previous attendees have indicated that CEUs have assisted them in securing approval to attend the conference.

WHAT SESSIONS ARE CEU-ELIGIBLE?

- All Tutorials, Papers, and Professional Development Workshops are CEU-eligible.

WHO MAY ATTEND THESE EVENTS?

- Tutorials and Professional Development Workshops are open to everyone. The Paper Sessions are limited to registered conference attendees.
- Does attending mean I automatically receive CEU credits? No. You have to let us know, via your registration, that you are interested in the credits. There is no charge for Paid Conference Attendees. However, if you are in an unpaid category (i.e., Exhibitor Personnel) there is a $45 charge, payable during registration. You may also register separately for the CEUs if you missed this step in your conference registration process.

HOW DO I RECEIVE CEUs AT I/ITSEC?

1. Be sure you are appropriately registered (you can confirm when you check in onsite) for CEU credits.
2. Be sure to have your conference badge scanned by a conference volunteer at each session you attend. Attendance is recorded electronically and required for CEU credit.
3. Your CEU transcript will come to you via the University of Central Florida, Division of Continuing Education. Ten contact hours equate to one CEU credit.

Contact Jana Breburdova at jana.breburdova@ucf.edu or 407-882-0247 for additional information.

Continuous Learning Points (CLPs)

The U.S. Department of Defense (DoD) acquisition workforce members are expected to earn Continuous Learning Points (CLPs) to stay current in leadership and functional acquisition skills that augment the minimum education, training, and experience standards established for certification purposes within their acquisition career fields. It is each acquisition member's responsibility to meet the goal of 40 CLPs each year and to meet the mandatory requirement of 80 CLPs every two years. Acquisition Professional Activities are allowed to count toward CLPs. CLPs are awarded in accordance with DoD-wide guidelines as augmented by Service-specific policies. I/ITSEC provides an excellent opportunity for the DoD acquisition workforce members to earn mandatory CLPs.

TUTORIALS

ROOM	0830–1000	1245–1415	1430–1600
TRACK 1: LVC 2 • CHAIR: SCOTT HOOPER			
320A	TENA/JMETC: Live-Virtual-Constructive Integration for Test and Training 21030	Introduction to HLA 21019	Distributed Interactive Simulation (DIS) 101 Tutorial: The Basics 21031
TRACK 2: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING • CHAIR: ROY SCRUDDER			
320B	Machine Learning Agents (ML Agents) for Training Intelligent Agents 21007	Understanding and Generating Synthetic Data for Computer Vision Applications 21008	Operationalizing Artificial Intelligence: Moving AI from the Lab to the Real World 21014
TRACK 3: CYBER & COMMUNICATIONS • CHAIR: LESLIE DUBOW			
320C	Zero Trust Security Architecture Applied to LVC Networks 21015	5G Fundamentals – What is a Commercial 5G Network and How Does My Handset Attach to It? 21037	Design for Additive Manufacturing (DFAM) and Cybersecurity: State-of-the-art and Future Vision 21013
TRACK 4: BEST TUTORIALS • CHAIR: LEE LACY, PH.D., CMSP			
320D	A Comprehensive Introduction to Medical Simulation 21005	Advanced Air Mobility (AAM) – Innovating Modeling & Simulation (M&S) to Revolutionize the Future of Transportation 21001	Addressing the Challenges of Rigorous Simulation Validation 21032
TRACK 5: LVC 1 • CHAIR: JULIANA SLYE			
320E	Live Virtual Constructive (LVC) Simulation Interoperability 101 21017	Distributed Event Integration and Execution 21009	Securing LVC Simulations on Your LAN and Across the WAN Using Data Distribution Service (DDS) 21010
TRACK 6: M&S FUNDAMENTALS • CHAIR: RANDOLPH M. JONES, PH.D., CMSP			
320F	Introduction to Department of Defense Modeling and Simulation 21020	Simulation Conceptual Modeling Theory and Use Cases 21002	An Introduction to Cognitive Systems for Modeling & Simulation 21003
TRACK 7: EMPLOYING M&S • CHAIR: S.K. (SUE) NUMRICH, PH.D., CMSP			
329	An Introduction to RIEDP Concepts for Environmental Data Sharing 21004	Optimizing Knowledge Acquisition in Extended Reality (XR) Training Applications Through Effective Design 21011	Experimentation Campaign: Launching into MDO 21029
TRACK 8: INSTRUCTIONAL SYSTEMS CONCEPTS • CHAIR: MIKE FREEMAN, ED.D.			
310C	Overview and Application of xAPI, cmi5, and xAPI Profiles 21023	Fundamentals of Adaptive Instructional Systems (AISs) 21028	

TUTORIAL SYNOPSES BEGIN ON PAGE 63 • PRESENTER BIOGRAPHIES BEGIN ON PAGE 72

0800 – 1000

TRACK 1: LVC 2
0830–1000 • ROOM 320A

TENA/JMETC: Live-Virtual-Constructive Integration for Test and Training

21030

The Test and Training Enabling Architecture (TENA) and the Joint Mission Environment Test Capability (JMETC) program provide an advanced set of interoperability software, interfaces, and connectivity for use in joint distributed testing and training. This tutorial will provide information about the how TENA works and why it is important to the test and training communities, with some comparison to other interoperability architectures. TENA provides testers and trainers software such as the TENA Middleware—a high-performance, real-time, low-latency communication infrastructure that is used by training range instrumentation software and tools during execution of a range training event. The standard TENA Object Models provide data definitions for common range entities and thus enables semantic interoperability among training range applications. The TENA tools, utilities, adapters, and gateways assist in creating and managing an integration of range resources. The current version of the TENA Middleware, Release 6.0.8, is being used by the range community for testing, training, evaluation, and feedback and is be used in major exercises in the present. A preview of the expected Release 6.1 will be presented.

JMETC is a persistent test and evaluation capability throughout the U.S. DoD, connecting many test ranges together, including a bridge to the JTEN training network; a set of TENA-compliant software middleware, interfaces, tools, and databases; and a process for creating large distributed test events. The combination of TENA and JMETC gives testers and trainers unprecedented power to craft a joint distributed mission environment that forges the future for innovative testing and training.

PRESENTER

EDWARD POWELL, PH.D., Ed Powell Consulting

TRACK 2: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING
0830–1000 • ROOM 320B

Machine Learning Agents (ML Agents) for Training Intelligent Agents

2107

Effective use of Machine Learning (ML) within the Department of Defense (DoD) is dependent on surfacing challenging problems for defense related scenarios and developing adequate ML benchmarks for these tasks. However, as these grand challenges are "solved," new challenges materialize requiring the creation of new environments, which is often time-intensive and requires specialized domain knowledge. Furthermore, developing hand-crafted intelligent agents (IA) to operate in these environments is equally challenging, time-consuming, and often intractable, resulting in resources spent with sub-optimal results. ML enables developers to create IAs which learn their behavior from data, as opposed to hard coding behaviors based on domain specific expertise. ML is used in many domains such as computer vision, gaming, and military tactics/decision making. For example, ML can be applied to military tactics in a number of interesting ways, with the most promising approach being developing software to have agency via a simulation. Suppose that we have a military strategy game, such as Starcraft II. If an input is given to an agent, such as a game screen or some state the agent has access to, and mapped to an output, such as the best decision for the agent to make, we can build an ML pipeline that can train an intelligent agent to take those inputs and learn a mapping function (producing the correct decision) to "win" the game. The two most prominent methods to teach agents are Reinforcement (RL) and Imitation Learning (IL). In RL, an agent is trained to generate a policy or set of instructions by taking in observations and performing actions. This policy is then optimized to maximize the cumulative reward that the agent receives while taking actions in an environment. IL, uses demonstrations that are recorded observation/action pairs, formally called the expert trajectory, to train the agent. IL is most useful when the reward function is difficult to define by hand or when it is simpler to show the agent what the appropriate behavior is. This tutorial will start with an introduction to the benefits of using ML to train IAs, highlighting use cases for ML-Agents throughout the DoD. Attendees will then learn how to use ML to train IAs leveraging an open-source project called ML-Agents. Lastly, attendees will learn how to train agents via reinforcement learning by sitting through a walkthrough on how to train several intelligent agents (in an adversarial setting) in a capture the flag scenario.

PRESENTERS

MIGUEL ALONSO, Unity Technologies
KARTHIK SUNDARAM, Unity Technologies

TRACK 3: CYBER & COMMUNICATIONS
0830–1000 • ROOM 320C

Zero Trust Security Architecture Applied to LVC Networks

21015

LVC training mandates a wide and highly connected network that connects a large number of users/devices to data/applications. Systems connect multiple locations and connect users/devices to data/applications that span from edge to cloud, taking a ZTA approach to the LVC network architecture is critical. Using the NIST ZTA (NIST SP 800-207) as a guide, with accurate and timely threat intelligence, LVC Networks can realize embedded security capabilities that enable the ecosystem (edge – network – data center – cloud) to operate as an integrated, secure platform.

Interconnecting multiple disparate devices and users to each other and across widely federated data and applications, LVC networks must be designed with the ZTA tenets in mind as described by NIST. ZTA has its roots in organizations that are geographically distributed or have highly mobile users and distributed edge nodes. ZTA approach to cybersecurity is critical as LVC objectives and demands necessitate greater connectivity to an increasing number of connected users, devices and sensors. An LVC network platform founded in the tenants of the NIST approach ensures interoperability via open standards while improving operational efficiencies that leverage visibility, automation, and the network platform.

ZTA approach enables risk reduction by constraining the adversaries' operational space. As defined by NIST, the abstraction of policy via the policy decision point in the control plane allows the network platform's logical components to communicate. Policy is executed via policy enforcement points located in the data plane as close to the "subject" or "resource" as possible – at machine speed. This approach spans across all the components of the LVC Network – including: training participants and support, user/device connections and connection of data and applications.

No application, participant, or device is provided access without establishing trust via the policy engine. Trust is built via multiple inputs computed in the control plane for the ultimate decision to grant access to a resource for a given subject – commensurate with the level of risk. Policy enforcement points (PEPS) are responsible for enabling, monitoring, and eventually terminating connections between a subject and an enterprise resource. PEPs enable granular micro-segmentation down to individual users, devices, sensors, data, workload and application.

Understanding logical components identified by NIST is essential for a successful ZTA implementation. Ensuring a robust, comprehensive LVC network platform that enables integrated, seamless policy decisions and policy enforcement is critical for modern cybersecurity. Integrating ZTA into holistic, end-to-end LVC architectures helps ensure mission success."

PRESENTERS
NEIL LOVERING, Cisco Systems, Inc.
ANDREW STEWART, Cisco Systems, Inc.
JOSEPH BEEL, Cisco Systems, Inc.

TRACK 4: BEST TUTORIALS
0830–1000 • ROOM 320D

A Comprehensive Introduction to Medical Simulation

21005

Simulation tools and techniques have been a part of acquiring medical knowledge and skills for over 4,000 years, with more scientific approaches emerging hand-in-hand with the European Renaissance. This tutorial is a comprehensive overview of medical simulation to include their use in addressing COVID-19 and pandemics, history, system taxonomies, devices and techniques for representing external and internal anatomy and physiology, the role of team training, specialized military medical applications, the growing role of AI in medical simulation, and criteria for current simulation-based medical training accreditation. The story includes manikins, part-task trainers, game-based systems, surgical simulators, standardized patients, physical prostheses, team training events, artificial intelligence techniques, and certifications.

The innovation and acceleration section shares new tools, techniques, and technologies that have emerged in 2021 and that are changing the nature of traditional training systems and events."

PRESENTERS
ROGER SMITH, PH.D., Soar Technology, Inc.
DANIELLE JULIAN, AdventHealth Nicholson Center
ALYSSA TANAKA, PH.D., Soar Technology, Inc.

TRACK 5: LVC 1
0830–1000 • ROOM 320E

Live Virtual Constructive (LVC) Simulation Interoperability 101

21017

The tutorial is intended for decision makers who have recently come in contact with distributed simulation and need a top-level understanding of Live, Virtual and Constructive (LVC) interoperability and the supporting standards, technology and processes. The purpose of this tutorial is to provide managers the necessary insight needed to support intelligent decision making. The tutorial will discuss the business and technical domains of the technology and how it can relate to their project. The tutorial will provide a top-level technology review of LVC interoperability, and provides sufficient insight into interoperability solutions and standards like DIS, HLA, TENA and DDS, the effective roles of interoperability gateways and cross domain solutions as well as applicable processes that step users through the use of LVC solutions. The tutorial provides a relevant use case as the mechanism to explain the concepts and the solutions required to achieve success.

PRESENTERS
KURT LESSMANN, Trideum Corporation
DAMON CURRY, Pitch Technologies US

TRACK 6: M&S FUNDAMENTALS
0830–1000 • ROOM 320F

Introduction to Department of Defense Modeling and Simulation

21020

This tutorial will describe the fundamental technologies, terms and concepts associated with Modeling and Simulation (M&S) and describe M&S development and application in the Department of Defense (DoD). The tutorial will cover various aspects of M&S including key M&S terms and concepts that describe M&S technology, development, and application. It will include: (a) M&S terminology and concepts used in the Department of Defense (DoD); (b) M&S technology, architectures and interoperability protocols and their role in enabling key functions in the DoD; (c) The processes for developing valid representations of: DoD warfighting capabilities, threat capabilities, natural environment, complex systems, cyber, autonomy, artificial intelligence/machine learning, and human and organizational behavior. The attendee will become familiar with how M&S is used in the DoD for operational purposes - especially training and other areas of direct warfighter support; and the DoD M&S role in enabling key functions of the Department. This tutorial will identify key policies and procedures for DoD M&S and present: (a) the role of Verification, Validation and Accreditation (VV&A) in ensuring that credible models and simulations meet the needs of their users; (b) the role of M&S Standards in the Defense Standardization Program and its role and impact in DoD M&S use; and (c) the function of the DoD Modeling and Simulation Enterprise Community of Practice (MSE_CoP). The tutorial will describe the characteristics and associated challenges of M&S applications within DoD functional areas including: Training, Analysis, Acquisition, Test and Evaluation, Planning, Medical, Mission Engineering, Autonomy, Artificial intelligence, DoD Research and Development/Employment, and Intelligence. The tutorial will also identify accessible DoD M&S information resources and explain the role of the USD (R&E) Modeling and Simulation Enterprise, as the focal point of DoD M&S information, practice, technology, and functional use.

PRESENTERS
JOHN DALY, Booz Allen Hamilton
JAMES COOLAHAN, PH.D., Coolahan Associates, LLC

TRACK 7: EMPLOYING M&S
0830–1000 • ROOM 329

An Introduction to RIEDP Concepts for Environmental Data Sharing

21004

This tutorial provides an overview of the fundamental concepts and components of RIEDP (Reuse and Interoperation of Environmental Data and Processes), developed within the Simulation Interoperability Standard Organization (SISO). The focus of RIEDP is on the harmonization of environmental/terrain database generation processes, and the means to exchange such generated data. RIEDP promotes reusability of database generation efforts and fosters interoperability between simulations by providing standardized rules, methods, and semantics for sharing data from key stages of the simulation database generation process. RIEDP leverages existing source data formats commonly used in GIS and simulation applications. RIEDP concepts and components are embodied in two SISO products: the RIEDP Data Model Foundations and the RIEDP Detailed Features Description. The tutorial will highlight key concepts from these RIEDP specifications and will provide an overview of the RIEDP Reference Process Model (RPM), the RIEDP Reference Abstract Data Model (RADM), and how RIEDP uses existing formats and a robust approach (including semantics through attributes and attribution, innovative and efficient use of metadata constructs, data organization on media, and a set of profiles for specific application sub-domains) to share and exchange environmental data.

PRESENTER

JEAN-LOUIS GOUGEAT, Sogitec Industries

TRACK 8: INSTRUCTIONAL SYSTEMS CONCEPTS
0830–1000 • ROOM 310C

Overview and Application of xAPI, cmi5, and xAPI Profiles

21023

Developed nearly two decades ago, the Sharable Content Object Reference Model (SCORM) is a set of interoperability standards for packaging and delivering online courses via web-browsers and Learning Management Systems (LMSs). However, SCORM is not extensible enough to support the myriad of technologies used in modern learning environments. In addition, SCORM does not provide sufficient guidance for capturing robust, interoperable learner performance data. DoD Instruction 1322.26 recommends the Experience Application Programming Interface (xAPI) data specification as the contemporary method for managing learner-performance data, and while xAPI and SCORM can be implemented together, a more modern approach to content packaging and delivery is warranted.

The cmi5 specification was created to replicate SCORM functionality with the intention of replacing SCORM as the de-facto format of online courses and traditional computer-based training. The underlying use cases were so similar between cmi5 and xAPI that the Aviation Industry Computer-Based Training Committee (AICC) led cmi5 effort adopted xAPI. The cmi5 specification defines a set of rules for how online courses are imported, launched, and tracked using an LMS and leverages xAPI to do so. Technically, cmi5 is an xAPI Profile, which means it inherits all of the characteristics mandated by the xAPI specification, but cmi5 also imposes additional requirements, including interoperability rules for content launch, authentication, session management, reporting, and course structuring, making it a sort of "super profile".

The cmi5 specification enables the packaging and delivery of distributed learning resources that sit outside of a web-browser (e.g., mobile apps, offline content). The cmi5 specification will play an important role in DoD's modernization, facilitating progress from SCORM-based LMS-centric courseware to a distributed learning "ecosystem" that delivers diverse learning opportunities across a range of federated platforms. This tutorial introduces learners to the core concepts of xAPI and cmi5 and of the structure and communication of xAPI and cmi5 data and systems. It describes cmi5 implementation details, best practices, as well as community activities and resources. Updated for 2021, this tutorial adds the latest best practices, updates from xAPI and DoD Policy, and access to new resources that will significantly increase cmi5 development productivity and reduce risk. The tutorial will include how to go "beyond cmi5" and dives into the best practices for design and development of xAPI data in specific use cases that can then be generalized and used in any discipline.

PRESENTERS

ANDY JOHNSON, Advanced Distributed Learning (ADL) Initiative (SETA Contractor)
ART WERKENTHIN, RISC, Inc.
MIGUEL HERNANDEZ, Advanced Distributed Learning (ADL) Initiative (SETA Contractor)

1245 – 1415
TRACK 1: LVC 2
1245–1415 • ROOM 320A

Introduction to HLA

21019

The High-Level Architecture (HLA) is the leading international standard for simulation interoperability. It originated in the defense communities but is increasingly used in other domains. This tutorial gives an introduction to the HLA standard. It describes the requirements for interoperability, flexibility, composability and reuse and how HLA meets them. It also describes the new features of the most recent version: HLA Evolved (IEEE 1516-2010) and the upcoming HLA version (HLA 4). Finally, it provides some recent experiences of the use of HLA in NATO M&S groups as well as an overview of recent evolution of Federation Object Models for military platform simulation, Space simulation and Air Traffic Control simulation. This tutorial is intended for all audiences; however, some familiarity with basic principles of distributed computing is recommended.

PRESENTERS

BJÖRN MÖLLER, Pitch Technologies
KATHERINE MORSE, CMSP, Johns Hopkins University Applied Physics Laboratory (JHU/APL)

TRACK 2: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING
1245–1415 • ROOM 320B

Understanding and Generating Synthetic Data for Computer Vision Applications

21008

The objective of Computer Vision (CV) research is to equip computers with humanlike perception capabilities so they can sense the environment, understand the sensed data, take appropriate actions, and learn from this experience to improve future performance (Sebe, Cohen, Garg, Huang, 2005). Today, we are already seeing CV based Artificial Intelligence (AI) systems throughout the defense and industrial sectors. There are autonomous vehicles that take video and other sensor information to detect objects, signs, and lane markings. Robotic systems that leverage CV to understand their environment to safely interact with dangerous objects and humans. In aviation maintenance, the Department of Defense (DoD) and industry are building training systems that have the ability to supplement or replace manual aircraft inspections by using CV to identify parts that need repair. Lastly, the DoD and industry are also using CV to aid in force protection by equipping cameras and drones with the ability to identify anomalous behavior, potential threats, and changes in the environment.

CV is primarily driven by Machine Learning (ML), which requires hundreds of thousands of data points. However, gathering high-quality labeled data to train ML models continues to be a major challenge. A 2019 survey found 96% of enterprises encounter training data quality and labeling challenges in machine learning projects (Haskins, 2019). Factors that make it difficult for an organization to collect sufficient labeled data necessary for robust ML models include: privacy and regulatory concerns, non-exhaustive examples of real-world scenarios leading to selection bias in ML models, and edge cases that are rare, expensive, or dangerous to recreate in real life.

Synthetic data is a viable solution to solve the data problems mentioned above for CV applications. Researchers at OpenAI (Tobin et al., 2017) and Google (Hinterstoisser et al., 2019) have successfully demonstrated the efficacy of synthetic data for real-world tasks such as object detection. This tutorial will highlight the wide range of CV applications that can benefit from synthetic data. Then we will walk through how to generate synthetic data at scale for CV, including all of the annotations, automatically labeled without human interaction. Lastly, we will walk you through a practical use case and demonstrate how Foreign Object Debris (FOD) systems can benefit from synthetic datasets.

PRESENTER

STEVE BORKMAN, Unity Technologies

TRACK 3: CYBER & COMMUNICATIONS
1245–1415 • ROOM 320C

5G Fundamentals – What is a Commercial 5G Network and How Does My Handset Attach to It?

21037

As networks evolve from 3G to 4G and now 5G, an all-connected world is becoming reality. A foundational understanding of commercial mobile network technology is necessary for experts and non-experts alike to understand everyday cyber activities and how cybersecurity protects networks. This tutorial will teach the audience how modeling, simulating, and applying various cybersecurity techniques to daily activities, such as attaching a mobile device to a network, surfing the web, and sending a text message, can help secure your device and information. In addition, this tutorial will educate the I/ITSEC audience on the basics of mobile network technology, and how simulation systems build a broad and deep understanding of cybersecurity scenarios in a mobile network environment. The commercial mobile network technology world is awash with terms and acronyms that even professionals find difficult to navigate. CACI subject matter experts will guide attendees through an overview of commercial mobile networks and fifth generation (5G) mobile network technology, explaining key terms and acronyms and detailing important definitions. We will explain the major components of networks, such as endpoint devices, radio access networks, backhaul, and core. We will use a modeling and simulation system to help attendees better visualize and understand 5G network protocols, and how a 5G endpoint device (e.g., a handset) attaches, detaches, and moves around across a network. The session will culminate with an overview of cybersecurity and how fundamental firewall, access control list (ACL) and encryption techniques can be applied to protect the end-user's devices and information. Several key topics of interest in mobile technology will also be explored. A discussion of endpoint devices will focus on showing how a device is uniquely identified by a network, and what a subscriber identity module (SIM) card is, and how it is used for authentication and authorization. A segment on radio access networks will detail the function and purpose of various form factors for access points, from large to small cells, and explain the benefits and tradeoffs for each. The backhaul and core discussion will also define, enumerate, and compare the varied architectural approaches to backhauling thousands of potential access points towards a common core network. The complete tutorial will provide a solid foundational knowledge base on commercial mobile networks and use modeling and simulation.

PRESENTERS

PAUL DAVIS, CACI
STEVEN KROPAC, CACI
PHILIP LAMOUREUX, CACI
PATRICK LAWRENCE, CACI
DAN WOJCIECHOWSKI, CACI

TRACK 4: BEST TUTORIALS
1245–1415 • ROOM 320D

Advanced Air Mobility (AAM) – Innovating Modeling & Simulation (M&S) to Revolutionize the Future of Transportationn

21001

The discipline of Transportation (i.e., the cooperative systems that enable mobility for humans, goods, and services) remains an anchor for a reliant nation that must safely, equitably, and sustainably evolve in response to societal needs and technological innovations. Due to a wide variety of complex challenges (e.g., ground infrastructure deterioration, traffic congestion, extreme weather events due to climate change, global pandemics, future "Black Swan" world events), we find ourselves at an unprecedented juncture in human history where trillions of dollars are required to transform a transportation infrastructure upon which we remain increasingly over-reliant. Advanced Air Mobility (AAM) is a bleeding-edge paradigm that enables diverse aviation markets to safely develop an air transportation system – often between underserved locations — using revolutionary new forms of aircraft. Most recently, despite the immeasurable tragedies associated with the COVID-19 pandemic, the time is now for scientists, engineers, and urban planners to re-imagine drastic opportunities to improve transportation logistics for human mobility – along with much-needed improvements to the supporting infrastructure - including re-purposing geography and structures (e.g., vacant land, buildings, surface parking lots).

The notion of a "Flying Car" has long-seemed nearer to science fiction than science fact, yet, recent technological advances are slowly manifesting these potentially transformative capabilities closer to reality. A surmised Flying Car network effectively combines ideal characteristics of both planes and cars; vehicles with "hybrid" capabilities that are more maneuverable while traversing 3D airspace as compared to 2D roadways. It is generally accepted that advanced Modeling & Simulation (M&S) must be substantially leveraged to dictate Test, Experimentation, and Validation of Flying Cars, and to affect a vastly improved understanding of the critical human-machine interface that will pervade their technological evolution and prospective long-term sustainability.

In this timely Emerging Topics Tutorial, we explore the technologically disruptive evolution of AAM and Flying Cars. To clarify the key challenges associated with wide-scale adoption, advanced M&S will enable testing and experimentation with Flying Car technologies as they continue to incrementally emerge. Aspects of the Live-Virtual-Constructive (LVC) taxonomy will be essential to ultimately enable the tactical examination of forecasted operational logistics (e.g., vertical takeoff/landing capabilities, Vertiport layout, placement, and design) and behavioral patterns (e.g., perceived benefits and concerns, use cases, willingness to acquire and hire) associated with the evolving human-machine interface. Notional aspects of planned M&S innovations related to Flying Cars will be highlighted throughout this presentation.

PRESENTERS

KEVIN HULME, PH.D., CMSP, The Stephen Still Institute for Sustainable Transportation and Logistics (SSISTL)
RACHEL SU ANN LIM, University at Buffalo
IRINA BENEDYK, University at Buffalo
STEPHEN STILL, University at Buffalo
PANAGIOTIS ANASTASOPOULOS, University at Buffalo
SHEIKH AHMED, University at Buffalo
GRIGORIOS FOUNTAS, Edinburgh Napier University

TRACK 5: LVC 1
1245–1415 • ROOM 320E

Distributed Event Integration and Execution

21009

Integration and execution of large distributed Live, Virtual, Constructive (LVC) events consume substantial time and resources. While the underlying distributed LVC technologies are mature, the processes for integrating events are not. The IEEE Std 1730-2010 Distributed Simulation Engineering and Execution Process (DSEEP) standard defines a process model for developing an event. DSEEP defines a set of seven steps divided into activities. The process model provides representative inputs and outputs for each activity. However, the user still must instantiate the process and develop artifact templates. The development of a robust process based on DSEEP is a substantial effort. The goal of the process is to produce a verified distributed LVC environment to conduct the event. While distributed LVC environments can be created without using a process, not using a process adds risks to the event. The first risk is that the integration fails, and it may be difficult to discover the reason. The second risk is that the unverified environment produces invalid results that might not be apparent until the results are used.

An instantiation of DSEEP was developed based on the authors' integration and execution of many distributed LVC events. This implementation has nine steps, divided into 27 activities. This process adds two additional steps to the process. One of the steps adds a tabletop wargaming step to work through the requirements. The second additional step develops a digital twin of the target system. A detailed set of processes, templates, and guidance on how to perform the selected activities is provided. The process covers the integration of simulations and tactical systems to meet the objectives of the LVC event.

The tutorial will provide an overview of the complete process. Selected steps are described in more detail. This will provide the detailed inputs, tasks, outputs, and examples for each activity in the step. The process includes issues related to distributed LVC environments using multiple distributed simulation architectures, live entities, and cyber.

The process described in this tutorial was developed to support distributed LVC Test and Evaluation. However, the process applies to research and development, training, and experimentation. This tutorial is beneficial for anyone involved in the integration and execution of large distributed events. The tutorial is particularly beneficial for engineers tasked with planning and executing distributed events. The tutorial does not require knowledge of the DSEEP standard. Integration and execution of large distributed Live, Virtual, Constructive (LVC) events consume substantial time.

PRESENTERS

MICHAEL O'CONNOR, CMSP, Trideum Corporation
KENNETH LeSUEUR, PH.D., U.S. Army Redstone Test Center

TRACK 6: M&S FUNDAMENTALS
1245–1415 • ROOM 320F

Simulation Conceptual Modeling Theory and Use Cases

21002

Simulation conceptual modeling is a critical step in simulation development frequently overlooked in the rush to demonstrate program progress. A simulation conceptual model is an abstraction from either the existing or a notional physical world that serves as a frame of reference for further simulation development by documenting simulation-independent views of important entities and their key actions and interactions. A simulation conceptual model describes what the simulation will represent, the assumptions limiting those representations, and other capabilities needed to satisfy the stakeholder's requirements. It bridges between these requirements and simulation design.

This tutorial will present the theory and application of simulation conceptual modeling as documented during the research done by the NATO MSG 058. In addition, Use Cases that have been drawn from previous conference presentations will be presented to illustrate how conceptual modeling has been performed. Additional work is necessary to mature the state-of-the-art of simulation conceptual modeling before a recommended practices guide could be standardized. This tutorial has been created to continue the maturation of the simulation conceptual modeling best practices.

PRESENTER

JACK BORAH, Borah Enterprises, LLC

TRACK 7: EMPLOYING M&S
1245–1415 • ROOM 329

Optimizing Knowledge Acquisition in Extended Reality (XR) Training Applications Through Effective Design

21011

Extended Reality (XR) encompasses technologies that blend virtual and real environments, including Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR). These emerging technologies are on the verge of mass adoption, as more devices are being sold and more domains are exploring unique applications. As interactive technology advances, so does its application to education and training. For example, e-learning, gamification, and immersive learning environments have all seen significant growth in utilization in recent years. In this vein, XR promises to provide a powerful capability to disseminate a vast array of instructional content appropriate for all types of learners. Given the recent increase in user interest and commercial adoption, XR is primed to greatly impact education and training – as it is currently doing in military, entertainment, and e-commerce domains. New opportunities for education and training afforded by XR have been increasingly recognized by researchers and practitioners alike. Because of the immense educational benefits, it has been argued that XR is one of the key emerging technologies for education and training. The concomitance of the real environment overlaid with virtual objects allows for visualization of abstract concepts and complex spatial relationships. It also provides the possibility to experience phenomena that are not possible, or safe to perform, in the real world. In general, XR technologies have the capability to disseminate a vast array of instructional content ranging in fidelity, complexity, affordances, and limitless combinations of virtual and real components. Given the increasing ubiquity of emerging XR technologies in education and training, it is imperative that course content creators and instructional system designers leverage relevant previous theoretical and empirical contributions to direct and optimize knowledge acquisition, transfer, and retention in XR educational and training applications. This tutorial will discuss research-based instructional strategies for guiding the design of XR educational and training content. Within the tutorial, the impact of learner's proficiency level, scenario elements (e.g., stressors, complexity, assistance, etc., and instantiation of formative evaluations are all considered with respect to their impact on XR training efficacy. This tutorial is meant to serve as a guide to drive effective and efficient design of XR educational and training applications. By the end of this tutorial, attendees will be able to implement effective techniques for designing XR-based training applications.

PRESENTER

VICTORIA CLAYPOOLE, PH.D., Dynepic, Inc.

TRACK 8: INSTRUCTIONAL SYSTEMS CONCEPTS
1245–1415 • ROOM 310C

Fundamentals of Adaptive Instructional Systems (AISs)

21028

Adaptive instructional systems (AISs) are artificially-intelligent, computer-based systems that guide learning experiences by tailoring instruction and recommendations based on the learning goals, needs (learning gaps), preferences and interests of each individual learner or team in the context of domain learning objectives (Sottilare & Brawner, 2018; Sottilare, Barr, Robson, Hu, and Graesser, 2018). Adaptive instructional systems, tools and methods enable an individual learner or team to acquire the necessary knowledge and skill to achieve a set of predefined learning objectives in a domain (subject or topical area) under study. AI-based methods are often used to reduce the cost and skills required to design and develop AISs.

The effectiveness of artificially-intelligent adaptive instructional systems (AISs) has highlighted a need in the US military (e.g., Army Synthetic Training Environment) for intelligent, tailored, guided instruction for both individuals and teams. AISs are able to automatically adjust feedback, support, and challenge level of instruction to focus instruction to the specific needs of individual learners and teams. The marketplace for AISs (e.g., intelligent tutoring systems and intelligent mentors) has grown to a point where the IEEE standards community sees merit in developing standards and recommended practices for AIS conceptual modeling, interoperability and evaluation under Project 2247. The prevalence of AI in the IITSEC community highlights the need to understand the basics of AIS design, development, deployment, and evaluation. This tutorial provides insight into fundamental AIS principles to support military training needs, emerging standards, interoperable conceptual models that make up AISs, effective adaptive instructional policies and strategies, authoring processes, and the AIS marketplace. We are proposing this tutorial as an introduction to AISs and a companion workshop to be held on Friday morning of IITSEC week.

PRESENTERS

ROBERT SOTTILARE, PH.D., Soar Technology, Inc.
JEANINE DeFALCO, PH.D., U.S. Army DEVCOM-STTC
XIANGEN HU, PH.D., The University of Memphis

1430 – 1600

TRACK 1: LVC 2
1430–1600 • ROOM 320A

Distributed Interactive Simulation (DIS) 101 Tutorial: The Basics

21031

Adaptive instructional systems (AISs) are artificially-intelligent, computer-based systems that guide learning experiences by tailoring instruction and recommendations based on the learning goals, needs (learning gaps), preferences and interests of each individual learner or team in the context of domain learning objectives (Sottilare & Brawner, 2018; Sottilare, Barr, Robson, Hu, and Graesser, 2018). Adaptive instructional systems, tools and methods enable an individual learner or team to acquire the necessary knowledge and skill to achieve a set of predefined learning objectives in a domain (subject or topical area) under study. AI-based methods are often used to reduce the cost and skills required to design and develop AISs.

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PRESENTERS

DON BRUTZMAN, Naval Postgraduate School
TERRY NORBRATEN, Naval Postgraduate School
CHRISTIAN FITZPATRICK, Naval Postgraduate School

TRACK 2: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING
1430–1600 • ROOM 320B

Operationalizing Artificial Intelligence: Moving AI from the Lab to the Real World

21014

Following our previous tutorial on developing and hosting analytics in the cloud, we continue that conversation with a tutorial on Operationalizing AI. Organizations in both government and the commercial sector struggle to transition AI from R&D and the lab into real-world, operational use. Anywhere from 50% to 85% of AI projects face technical failure or cannot provide sufficient return-on-investment (ROI), according to various industry analysts and research firms. Purposeful orchestration of lines of effort improves that ROI by (a) ensuring that controlled development and testing space account for real world challenges; and (b) designing for deployment from the onset. Whether the operating environment is in a corporate office or a forward operating base, deploying AI in a way that provides the most value is paramount. Operationalizing AI guarantees that value by aligning technical performance and processes with mission utility to optimize AI implementation, from machine learning model development all the way through to deployment and sustainment.

In this tutorial, we'll cover what it means to work with AI; applications of prototype vs. operationalized AI; and tangible processes that can be leveraged to realize real world AI solutions. We'll base the tutorial in examples from our experience and lessons learned operationalizing AI in some of the most demanding environments in the world, including deploying to OCONUS sites under the DoD's Project Maven; expediting pathways to production for C5ISR edge capabilities; and optimizing small form factors for organizations with constrained SWAP-C. Specific to Modeling and Simulation, we will discuss a reference architecture to operationalize AI.

PRESENTERS

JOE ROHNER, Booz Allen Hamilton
KAYE DARONE, U.S. Army Training and Doctrine Command
CUTTER BRENTON, Booz Allen Hamilton
COURTNEY CROSBY, Booz Allen Hamilton

TRACK 3: CYBER & COMMUNICATIONS
1430–1600 • ROOM 320C

Design for Additive Manufacturing (DFAM) and Cybersecurity: State-of-the-art and Future Vision

21013

An ongoing concern with critical and ongoing relevance to multidisciplinary Modeling & Simulation (M&S), and across many I/ITSEC domains of interest — is the emergent and evolutionary process relationship between Design and Manufacturing. Lighter, stronger, and more complex materials, shapes, subsystems, and design components can be achieved by leveraging advanced, integrated, and cooperative design & additive manufacturing technologies in a manner that is more process and cost-efficient than traditional standalone product design, and numerous conventional (and antiquated) "subtractive" methods of manufacture. As these technologies continue to mature, the iterative pipeline between preliminary brainstorming, to Concept Modeling, to 2D computer-aided design, to 3D digital (solid model) Design, to Rapid Prototyping, to final product Manufacturing is continually converging into a holistic process continuum that will ultimately improve design process efficiency and effectiveness, final product integrity, and overall rates of success.

However, as with all disruptive and bleeding-edge technologies, related cybersecurity concerns have already begun to manifest within the advanced technological domains of 3D Printing (3DP) and Design for Additive Manufacturing (DFAM). Open source features and subsequent "democratization" of DFAM technologies that permit the production of items that were once limited to factories imparts an inherent flexibility that has opened the door for cybercrimes, terrorist acts, and other untoward activities. Accordingly, in this timely and innovative emerging topics Tutorial, we explore and investigate how "Innovating and Accelerating Training: Adapting to an Unexpected Future!" — with respect to the critical and ever-emerging interrelationship between 3DP/DFAM — and Cybersecurity can immensely benefit an M&S practitioner be better prepared for the future. After a brief exploration of foundational material (e.g., Design/Manufacturing fundamentals), we explore recent and timely examples of cybersecurity concerns related to 3DP

and DFAM. In spite of these recent and ongoing cautionary tales, we then highlight significant examples and Case Studies, each drawn from current literature, to demonstrate how recent industry has made optimal use of the DFAM pipeline — and across different domains of interest (e.g., aerospace, biomedical, and manufacturing). These topics and subject areas will be presented directly and explicitly with relation to the essential context of advanced M&S, as well as the overarching I/ITSEC mission — and its key foundational pillars — Training, Simulation, and Education.

PRESENTERS

SOURABH SAPTARSHI, North Carolina State University
KEVIN HULME, PH.D., CMSP, The Stephen Still Institute for Sustainable Transportation and Logistics (SSISTL)

TRACK 4: BEST TUTORIALS
1430–1600 • ROOM 320D

Addressing the Challenges of Rigorous Simulation Validation

21032

The process of validation is essential to the credible and reliable use of any simulation. Although Department of Defense policy and guidance increasingly emphasizes the importance of rigorous validation founded in the application of strong statistical analysis, implementation of rigorous validation continues to face multiple challenges. This tutorial will address several of those challenges:

- How to identify, collect, and combine validation referent data (what the simulation results will be compared to)
- How to identify the simulation measures and metrics to use as the basis of comparison (the aspects of the results that will be compared to the referent)
- Methods to apply when performing the results/referent comparison
- How to quantify risk and residual uncertainty associated with the application of the simulation

The tutorial will enhance the learning experience by incorporating lessons learned derived from the many VV&A applications with which the authors have been involved.

PRESENTERS

SIMONE YOUNGBLOOD, The Johns Hopkins University Applied Physics Laboratory (JHU/APL)
MIKEL PETTY, PH.D., University of Alabama in Huntsville

TRACK 5: LVC 1
1430–1600 • ROOM 320E

Securing LVC simulations on your LAN and Across the WAN Using Data Distribution Service (DDS)

21010

Integrating global simulation and training systems is hard. Legacy simulators use different standards for data, voice, and video, while modern architectures demand the use of cloud-based and distributed assets. New security requirements force integrators to suddenly become experts in information assurance.

How can systems integrators keep pace and limit integration time to meet today's emerging threats? This requires training environments that can be quickly assembled and reconfigured from ready-made components and networks. Attend this tutorial to learn how Data Distribution Service (DDS) can ease integration, while also delivering National Security Agency (NSA) tested security for real-time systems over Local and Wide Area Networks (LAN/WAN).

DDS is a popular open standard managed by the Object Management Group (OMG). DDS is the connectivity framework that meets the stringent interoperability and real-time requirements of the defense industry, and is currently used in hundreds of deployed systems. DDS seamlessly stitches together legacy simulations, while adding humans and hardware in the loop, to create new secure LVC environments that can share real, augmented and virtual realities. These environments can run in a single lab or across multiple sites, with DDS response times matching physics-speed.

This tutorial gives an introduction to the DDS and DDS Security standards. Learn how to use DDS Security to secure real-world Hardware-In-Loop (HIL) systems that already communicate over DDS to distributed LVC Simulations. The tutorial describes how to integrate DDS with existing simulation standards, an area where DDS can add Quality of Service (QoS). QoS brings new levels of real-time performance and scalability, adding robust security for individual topics of simulation data. The tutorial introduces you to a new Real-Time WAN Transport that extends DDS to enable secure, scalable, and high-performance communication over WANs, including public networks. The Real-Time WAN Transport uses UDP as the underlying IP transport-layer protocol to better anticipate and adapt to the challenges of diverse network conditions, device mobility, and the dynamic nature of WAN system architectures. Finally, the tutorial highlights recent LVC Simulation user experiences with DDS, and offers an overview of deployed systems using DDS in systems integration labs, and with LVC training simulators today.

This tutorial is intended for all audiences, though some familiarity with the basic principles of distributed computing is recommended.

PRESENTERS

DAN KING, Real-Time Innovations
ROBERT PROCTOR, Real-Time Innovations

TRACK 6: M&S FUNDAMENTALS
1430–1600 • ROOM 320F

An Introduction to Cognitive Systems for Modeling & Simulation

21003

There are increasing requirements for automated reasoning abilities across the broad spectrum of modeling and simulation, as well as in battlefield information and control systems. Additionally, the cognitive capabilities that have been developed and tested in simulation are migrating to real-world systems. Cognitive systems represent a maturing computational approach to intelligence that can provide robust, scalable, and adaptive decision making. This tutorial provides an introduction to cognitive systems, concentrating on production system computation and high-level design of human-like reasoning systems. We draw examples and comparisons from existing cognitive systems, focusing on the tradeoffs between cognitive and non-cognitive modeling approaches. The tutorial content does not require any specialized knowledge, but some experience with software engineering or behavior modeling can be helpful. Attendees will learn to recognize problems that suggest cognitively based solutions, and they will be better able to assess risks, costs, and benefits of different approaches. This tutorial is

targeted toward developers who might be interested in cognitive approaches to software engineering, as well as customers who have problems that may be amenable to a cognitive approach.

PRESENTERS

RANDOLPH JONES, PH.D., CMSP, Soar Technology, Inc.
DYLAN SCHMORROW, PH.D., Soar Technology, Inc.

TRACK 7: EMPLOYING M&S
1430–1600 • ROOM 329

Experimentation Campaign: Launching into MDO

21029

Today we find the term "experimentation" in many documents, particularly those revolving around the topic of multi-domain operations (MDO). But what do we mean by experimentation? Do we all mean the same thing? Discovery experimentation and experimentation campaigns can be very powerful in exploring and defining new capabilities whether materiel or evolution of tactics, techniques and procedures to account for new challenges. Discovery experimentation is a process for using simulation to place emerging technologies in the hands of warfighters engaged in virtual battlefields to explore the military utility of new concepts for using emerging systems. Discovery experimentation is designed to allow learning and modification from trial to trial and in that way differs significantly for both traditional scientific experimentation and technology demonstrations. It can be used to explore military utility of new technologies, development of new tactics, techniques and procedures for emerging systems, definition of requirements for control devices for new systems, and consequent needs for new training. This tutorial will walk through the definition of discovery experimentation and experimentation campaigns, illustrating the concepts with a partial discovery campaign completed in 2016 to test a new concept in close air support. Using the definitions and example provided, the tutorial will go on to explore the potential roles of discovery experimentation and experimentation campaigns in the evolution of concepts and capabilities for multi-domain operations. The presentation will highlight briefly the current experiments including Army's Project Convergence, Navy's Project Overmatch, the Air Force's Digital Advanced Battle Management System of Systems (Digital ABMS), and finally the concept of Joint All Domain Command and Control (JADC2). The presentation will note the roles of constructive and LVC modeling and simulation capabilities in addition to modified live testing, including the issues of data collection. The importance of scoping and choosing rapid modification of simulation tools will be highlighted as a means of making experimentation campaigns viable in a resource-constrained environment.

PRESENTER

S. K. NUMRICH, PH.D., CMSP, Institute for Defense Analyses

AUTHOR BIOGRAPHIES

MIGUEL ALONSO is a machine learning engineer, data scientist, software engineer, and researcher with a proven track record of building successful products and leading teams to deliver. His interests include: deep learning for computer vision, robotics, perception, and control; deep reinforcement learning and optimal control; and broad applications of artificial intelligence, machine learning and data science. Mr. Alonso is passionate about developing solutions in domains such as image and video analysis, augmented reality, energy, and autonomous systems. He is a senior member of IEEE and a member of ACM, Tau Beta Pi and Eta Kappa Nu.

JOSEPH BEEL leads Defense Business Development and Capture Management at Cisco Systems, Inc. He is a retired naval officer and served as a helicopter pilot and acquisition professional serving in command in both the Naval Air Systems Command and Space and Naval Warfare Systems Command (now Naval Information Warfare Command). He earned a Master of Science degree in Operations Research (with distinction) at the Naval Postgraduate School and a Bachelor of Science degree in Mechanical Engineering at the U.S. Naval Academy.

JAKE BORAH is the co-owner of Borah Enterprises LLC. He is a Senior Simulations/Learning Architect for the U.S. Army PM ITTS Persistent Cyber Training Environment. Jake is a Charter Certified Modeling and Simulation Professional (CMSP). He has frequently supported U.S. and Canadian government sponsored military simulation projects because of his mastery of the M&S technology, and expertise in High Level Architecture federation development. Jake has a B.S. from the United States Air Force Academy and a Master of Aeronautical Science degree from Embry-Riddle Aeronautical University.

STEVE BORKMAN is senior software developer for the Computer Vision team at Unity Technologies, where he works on pushing the limits of quality and efficacy of synthetic data for training computer vision models. Prior to Unity, he has approximately twenty years of experience in the model and simulation community, primarily working on research topics involving 3D terrain models and mobile applications.

CUTTER BRENTON is a strategic innovator, leveraging his role as a Director/Principal for Booz Allen Hamilton against novel requirements and emerging domains specific to analytics and artificial intelligence (AI) for the U.S. Government. His focus on military and global defense clients spans 10 years and is marked by transformative solutions for operationalizing AI, architecting machine learning pipelines, and orchestrating data to deliver actionable insights. Coupled with a focus on advancing and integrating technologies through investments and R&D into DoD mission spaces, Cutter's success leans forward to take AI projects from the lab to real world operations.

DON BRUTZMAN is a computer scientist and associate professor working in the Modeling Virtual Environments & Simulation (MOVES) Institute at the Naval Postgraduate School (NPS) in Monterey California. A shared theme across all his projects is establishing web-scale distributed simulation capabilities. Currently he co-chairs the Extensible 3D (X3D) Working Group for the Web3D Consortium. He wrote the book *X3D Graphics for Web Authors* with co-author Leonard Daly, published April 2007 by Morgan Kaufmann. He is a retired naval submarine officer and principal investigator for the Network Optional Warfare (NOW) project. His research interests include underwater robotics, real-time 3D computer graphics, artificial intelligence (AI), and distributed networking for large-scale virtual environments (LSVEs).

VICTORIA L. CLAYPOOLE, PH.D., is the manager of New Horizons at Dynepic, Inc. With previous experience at the Air Force Research Lab and her current work with the United States Navy, Dr. Claypoole's research interest lies at the intersection of increasing warfighter readiness and advancing scientific knowledge. Her previous work has examined how individual differences and social cues can improve attention and enhance enemy threat detection. Currently, her work is centered on leveraging emerging technology to develop next-generation training and operational support for the warfighter. Dr. Claypoole has earned numerous professional awards, including the University of Florida's 40 under 40, the University of Central Florida's 30 under 30, and several Best Paper awards at various conferences. She received a Ph.D. in Human Factors and Cognitive Psychology and a Master's in Modeling and Simulation from the University of Central Florida.

JAMES E. COOLAHAN, PH.D., is the chief technology officer of Coolahan Associates, LLC, having retired from full-time employment at the Johns Hopkins University Applied Physics Laboratory (JHU/APL) in December 2012 after 40 years of service. He chaired the M&S Committee of the Systems Engineering Division of the National Defense Industrial Association from 2010 through 2016, and teaches courses in M&S for Systems Engineering in the JHU Engineering for Professionals M.S. program. He holds B.S. and M.S. degrees in Aerospace Engineering from the University of Notre Dame and the Catholic University of America, respectively, and M.S. and Ph.D. degrees in Computer Science from JHU and the University of Maryland, respectively.

DAMON CURRY has 30 years experience in the simulation industry specializing in distributed training systems, 3D visualization, and 3D terrain. He helped start several successful simulation industry companies and is presently Pitch Technologies' manager for business development in North America. Damon is co-inventor of a realtime image processing technique and a wireless video transmission method for virtual reality with one patent awarded and another patent pending. Prior to working in the simulation industry, he served 16 years with the U.S. Air Force, including software engineering on cruise missiles and avionics engineering on the F-16. He is a graduate of The Ohio State University with a Bachelor of Science in Electrical Engineering.

JOHN DALY is a senior engineer with Booz Allen Hamilton. He currently leads a team providing modeling and simulation technical and policy support to the Defense Modeling and Simulation Coordination Office. He has worked with OSD, Joint Staff, COCOM, Service, and DISA clients in the development of simulation systems for: training, acquisition, operational decision support, visualization of complex phenomena, testing, analysis, and operational simulation applications embedded in command and control systems.

KAYE DARONE is the lead for data science and the deputy for information management at the TRADOC Directorate of Intelligence (G-2), headquartered at Ft. Eustis, VA.

PAUL DAVIS is the principal scientist for the Internet and Cybersecurity Research Department at CACI. Over 25 years background developing innovative technologies and systems across broad areas including high speed digital and RF design, optical transport, network security, protocol analysis, signal processing, and embedded software for custom communications in support of the DoD and IC. He has been awarded several patents in wavelet image compression. He is the principal architect of CACI LiveRAN, bringing high-fidelity live 4G(LTE) / 5G capabilities to bit-accurate real-time modeling and simulation.

JEANINE A. DeFALCO, PH.D., is a research psychologist (adaptive training) with the Army Futures Command, DEVCOM-STTC, Orlando. Current research projects include supporting ethical decision making mediated by human virtual agents, and developing pedagogical models for the Generalized Intelligent Framework for Tutoring (GIFT) to accelerate expert problem-solving in critical care medical education. Dr. DeFalco has recently been elected to the executive committee of the International Society for AI in Education (2020), and has been active member of IEEE's working group to develop standards for adaptive instructional systems (AISs) (2018). In 2019, Dr. DeFalco was recognized with the NTSA Modeling and Simulation Award, Education/Human Performance – Team Award, for Outstanding Achievement in Modeling and Simulation for her contributions on The Generalized Intelligent Framework for Tutoring (GIFT). Dr. DeFalco received her Ph.D. in Psychology from Columbia University (2017), specializing in Human Development/Cognitive Studies in Education with a concentration in Intelligent Technologies. Dr. DeFalco holds a Master's in Educational Theatre from New York University, has a Masters in Drama Studies from Johns Hopkins University, and a Bachelor's in History and Theatre from Long Island University.

STEVE FARROW is the business development executive at CACI International Inc's Training and Warfighter Readiness (TWR) business unit, located in Orlando, Florida. In this role, he is responsible for program growth and long-term TWR new business development. CACI's TWR unit is primarily focused on live, virtual, and constructive training and services for the U.S. Department of Defense and international partners. Mr. Farrow has worked in a variety of positions over his more than 30 years in the defense industry and has broad knowledge of the training market, including experience with and detailed technical understanding of virtual, augmented, mixed, and cross reality applications. Mr. Farrow holds a Bachelor of Science degree in Electrical Engineering from the University of Central Florida and a Masters of Business Administration degree from Webster University.

JEAN-LOUIS GOUGEAT holds a Master's degree in Electronics and Communications and an Engineering degree in Telecommunications (1987). He has been a senior project manager at SOGITEC since 2001. He has 30 years of experience with R&D projects for the French MoD, and more specifically 25 years in simulation projects for training of military personnel, including company level training with live simulation, flight training with virtual simulation and command & staff training with constructive simulation. He is in charge of the development of Distributed Mission Operation (DMO) and Live

AUTHOR BIOGRAPHIES

Virtual Constructive (LVC) activities at Sogitec. In this area, he was project manager of the AXED project aiming at developing the DMO/LVC in the French Air Force. He has been involved in various international efforts within NATO, from the genesis of the NATO PATHFINDER programme to the on-going MSG-165 on mission training via distributed simulation among Alliance Air Forces. He is the Chairman of the Simulation Interoperability Standard Organisation (SISO) Product Development Group (PDG) on the Reuse and Interoperation of Environmental Data and Process (RIEDP).

MIGUEL HERNANDEZ is a SETA contractor and senior system engineer serving with the Advanced Distributed Learning (ADL) Initiative. In this role, he provides technical oversight of multiple programs related to competency-based learning, performance tracking, and data analytics. His current focus is on the establishment of an ADL research portfolio that addresses many of the key challenges facing competency-based education in our military today. In this capacity, he serves as a liaison between DoD, the services, and other DoD agencies to build a comprehensive roadmap for transitioning the next generation of learning tools into an operational environment. Prior to working with ADL, he spent six years working on the modernization of learning tools and technologies for the Navy. He holds a Bachelor's degree in Electrical Engineering from Florida Atlantic University and is a U.S. Army veteran.

XIANGEN HU, PH.D., is a professor in the Department of Psychology, Department of Electrical and Computer Engineering and Computer Science Department at The University of Memphis (UofM) and senior researcher at the Institute for Intelligent Systems at the UofM and is professor and dean of the School of Psychology at Central China Normal University. Dr. Hu received his M.S. in Applied Mathematics from Huazhong University of Science and Technology, M.A. in Social Sciences, and Ph.D. in Cognitive Sciences from the University of California, Irvine. Dr. Hu is the director of Advanced Distributed Learning (ADL) Partnership Laboratory at the UofM, and is a senior researcher in the Chinese Ministry of Education's Key Laboratory of Adolescent Cyberpsychology and Behavior.

KEVIN F. HULME, PH.D., CMSP, received his doctorate from the Department of Mechanical and Aerospace Engineering at the University at Buffalo, specializing in multidisciplinary analysis and optimization of complex systems. Currently, he serves as the Program Manager for The Stephen Still Institute for Sustainable Transportation and Logistics at the University at Buffalo, and also serves as the Technical Director for its Motion Simulation Laboratory. Dr. Hulme's current areas of technical focus include: game-based approaches for applied modeling and simulation, human factors research in autonomous and connected vehicles (both ground and flight), simulation for advanced air mobility, experiential learning within next-generation engineering curriculum design, and Design for Additive Manufacturing. Dr. Hulme is a Certified Modeling and Simulation Professional (CMSP).

ANDY JOHNSON is a SETA contractor and serves as the specifications and standards manager at the ADL Initiative. His current focus at the ADL Initiative is on the identification of new standards and specifications that promote interoperability across DoD systems. Andy has worked with the ADL Initiative for over 15 years and was one of the previous developers on the Sharable Content Object Reference Model (SCORM). Andy received both his bachelor's degree in Computer Science and master's degree in Education, Communication and Technology from the University of Wisconsin-Madison.

RANDOLPH M. JONES, PH.D., CMSP, senior artificial intelligence engineer and co-founder at Soar Technology, Inc, is a leading developer of knowledge-rich intelligent agent software. He has been principal investigator for a variety of advanced R&D projects funded by ONR, ARI, DMSO, DARPA and other DOD agencies. He has previously held teaching and research positions at Colby College, the University of Michigan, the University of Pittsburgh, and Carnegie Mellon University. His areas of research include computational models of human learning and problem solving, executable psychological models, and full-spectrum intelligent behavior models. He earned a B.S. in Mathematics and Computer Science at UCLA, and M.S. (1987) and Ph.D. (1989) degrees from the Department of Information and Computer Science at the University of California, Irvine.

DANIELLE JULIAN is a research scientist at AdventHealth's Nicholson Center. Her current research focuses on robotic surgery simulation and effective surgeon training. Her current projects include intelligent tutoring system, rapid prototyping of surgical education devices, and the evaluation of robotic simulation systems. She is a certified instructor for surgical robotics courses delivered to surgeons and OR staff members. Her background includes research in human factors and learning and training to enhance the higher-order cognitive skills of military personnel. She is currently a Ph.D. student in Modeling and Simulation at the University of Central Florida where she previously earned an M.S. in Modeling and Simulation, Graduate Simulation Certificate in Instructional Design, and a B.S. in Psychology.

DAN KING is a software integration engineer with Real-Time Innovations (RTI). Dan earned a B.S. in Electrical Engineering from the University of Tennessee-Knoxville and has spent the past 10 years working on distributed system architecture for a variety of industries. His current focus is on using RTI Connext DDS to solve challenges in modeling and simulation, energy systems, and security.

STEVEN KROPAC is vice president of the Internet and Cyber Research Department at CACI. He has over 20 years of experience as a subject matter expert on global telecommunications network architecture, design and implementation. This includes several network and Network Element (NE) technologies including Optical Transport, IP routing and switching, traditional and next generation mobile network technology (3G, 4G, 5G, and beyond) as well as traditional and next generation public switched telephone networks. Over the last 15 plus years, Mr. Kropac has been building a team of cyber security, information security and network assurance experts primarily focused on security analysis of networks and network elements. His team consists of engineers and scientists with a strong background in telecommunications network technology, cybersecurity, reverse engineering, software development, protocol analysis and system engineering. Mr. Kropac holds a Master's in Computer Engineering from Stevens Institute of Technology.

PHILIP LAMOUREUX is a cyber systems engineer at CACI, focused on mobile telecommunications networks. In this role, he focuses on emerging standards and deployments of 5G networks and potential security risks. Mr. Lamoureux has over 25 years experience in mobility network systems engineering, architecture and technical consulting. His expertise includes radio access (including small cells), network virtualization, mobile edge compute (MEC), mobile network backhaul, network timing, system reliability/availability, network management, and performance data collection and analytics. A particular area of interest is Public Safety applications of 5G and LTE. Mr. Lamoureux holds a Masters Degree in Electrical Engineering from Columbia University, and is co-inventor of 9 U.S. patents in radio and transport technology.

PATRICK LAWRENCE has over 30 years of experience in the telecommunications industry with focus areas in Transport Networks and Service Provider Network Management Systems. He is the Product Manager for new and emerging modeling and simulation systems and one of the technical architects for related mission support cyber solutions. Mr. Lawrence holds a Master's degree from Cornell University in Electrical Engineering.

KURT LESSMANN is the co-founder and Chief Technology Officer of Trideum Corporation headquartered in Huntsville, AL. Trideum, an Honor Roll Member of Inc. 5000, focuses on several core competencies: live, virtual and constructive (LVC) interoperability, test & evaluation, training solutions, cybersecurity and user centered design. Mr. Lessmann has supported the modeling and simulation (M&S) and LVC communities for the past 25 years where he has been involved in interoperability standards development and deployment for DIS, HLA and TENA. His primary focus has been applying M&S and LVC technologies to enhance weapons system test and evaluation effectiveness. He is currently focusing on developing solutions that provide an operationally realistic distributed LVC environments that support weapon system cybersecurity vulnerability assessments. He holds a Bachelor of Aerospace Engineering Degree from Auburn University, and lives in Huntsville, AL.

KENNETH G. LeSUEUR, PH.D., serves as the chief technologist of the Modeling & Simulation Division at the U.S. Army Redstone Test Center (RTC). His work and research have been concentrated in HWIL testing, distributed testing, modeling and simulation, and high performance computing. He received his master's degree and doctorate in Computer Engineering at the University of Alabama in Huntsville.

RACHEL SU ANN LIM holds a Master's degree in Biomedical Engineering from University at Buffalo, The State University of New York.

NEIL LOVERING is a senior multi-domain architect at Cisco Systems. He was once a communications platoon leader in the 82nd Airborne Division, and has been providing security solutions to customers across the entire federal space for almost two decades with Cisco. He holds a bachelor of science degree from the University of Southern California in Computer Science. He has maintained his CCIE certification for more than 25 years, which is one of the most prestigious certifications in the networking industry.

BJÖRN MÖLLER is the president and co-founder of Pitch Technologies, the leading supplier of tools for HLA and other simulation standards. He received an M.S. in Computer Science and Technology after studying at Linköping University and Imperial

AUTHOR BIOGRAPHIES

College, London. Mr. Möller has more than thirty years of experience in high-tech R&D companies, with an international profile in modeling and simulation. His experience includes positions in SISO and IEEE standards development groups such as vice chair for HLA, chair of the Real-time Platform Reference FOM and chair of the Space Reference FOM. Mr. Möller also served as secretary in the NATO MSG-080 group for Security in Collective Mission Training.

S. K. NUMRICH, PH.D., CMSP, began her career at the engineering level of modeling and simulation and moved gradually into parallel and distributed simulation. She led a panel for The Technical Cooperation Program (U.S., UK, CA, AUS, NZ) in distributed simulation and represented the U.S. on the NATO Studies, Analysis and Simulation (SAS) panel as the simulation expert. Sue served as the director of technology for the Defense Modeling and Simulation Office. Since 2005 she has been a research staff member at the Institute for Defense Analyses where she has worked with the use of military simulation, the incorporation of human activity and behavior into simulations, and the validation of a variety of simulations. She founded and was the first chair of the Tutorial Board. Sue authored four book chapters and over 50 technical papers and has had two academic appointments. A Fellow of the Acoustical Society of America, Sue was selected as the I/ITSEC 2018 Fellow.

MICHAEL J. O'CONNOR, CMSP, is chief technologist at Trideum Corporation. Mr. O'Connor has more than 25 years' experience in modeling and simulation (M&S). He has been a key participant in the development of distributed modeling and simulation standards, including IEEE 1278 and IEEE 1516. He has held many positions in the community, including Chairman of the SISO Standards Activities Committee, Chairman of the SISO Executive Committee, and Editor of the Gateway Filtering Language standard. He has served as the chair of the I/ITSEC Simulation Subcommittee and the I/ITSEC Training Subcommittee. He has led the development of multiple simulations using DIS, HLA, and TENA. Mr O'Connor has led the technical integration of several large multi-architecture distributed events. He holds a bachelor's degree in Computer Engineering from Auburn University, and a master of science in Computer Science from the University of Alabama in Huntsville. Mr. O'Connor is a CMSP.

MIKEL D. PETTY, PH.D., is the senior scientist for modeling and simulation in the Information Technology and Systems Center and an associate professor of Computer Science at the University of Alabama in Huntsville. He previously served as director of UAH's Center for Modeling, Simulation, and Analysis for ten years. Prior to joining UAH, he was chief scientist at Old Dominion University's Virginia Modeling, Analysis, and Simulation Center and Assistant Director at the University of Central Florida's Institute for Simulation and Training. He received a Ph.D. in Computer Science from the University of Central Florida in 1997. Dr. Petty has worked in modeling and simulation research and development since 1990 in areas that include verification and validation methods, simulation interoperability and composability, human behavior modeling, multi-resolution simulation, and simulation software frameworks. He has published over 235 research articles, chapters, and papers and has been awarded over $17 million in research funding. He served on National Research Council and National Science Foundation committees on modeling and simulation, is a Certified Modeling and Simulation Professional, and is Editor-in-Chief of the scholarly journal *SIMULATION: Transactions of the Society for Modeling and Simulation International*. He has served as dissertation advisor to twelve graduated Ph.D. students in four different academic disciplines: Modeling and Simulation, Computer Science, Industrial and Systems Engineering, and Computer Engineering. His former students include the first two people to receive Ph.D.s in Modeling and Simulation at Old Dominion University and the first five people to receive Ph.D.s in Modeling and Simulation at UAH.

EDWARD T. POWELL, PH.D., is a lead architect for the Test and Training Enabling Architecture. After receiving his Ph.D. in Astrophysics from Princeton University, he worked for the Lawrence Livermore National Laboratory performing simulation-based analysis. He moved to SAIC (now Leidos) in 1994, and participated as lead architect in some of the most complex distributed simulation programs in DoD, including the Joint Precision Strike Demonstration (JPSD), the Synthetic Theater of War (STOW), the Joint Simulation System (JSIMS). He then worked in the intelligence community on architectures for integrating large-scale diverse ISR systems. He has been the lead architect for TENA for fifteen years, and is currently working on expanding the applicability of TENA, and integrating TENA with broader DoD-wide data management and big data analysis systems. Currently, he owns his own consulting company specializing in simulation and systems architecture and engineering.

ROB PROCTOR is a lead field application engineer for Real-Time Innovations. He received his B.S. from Embry-Riddle Aeronautical University in Aerospace Studies and his M.S. from the University of South Florida in Engineering Management. Rob has over 24 years of experience in A&D Embedded SW development. Prior to his time as a field application engineer, he developed and implemented real time embedded software at major aerospace and defense corporations. His roles have included developing software and system designs, mission-management and display processing systems. Rob is also involved with the SISO Layered Simulation Architecture (LSA) Study Group.

JOE ROHNER is a director of artificial intelligence and data science and leads Booz Allen's Strategic Innovations Group on the West Coast. Additionally, he serves as the firm's market integration lead of AI/ML for the Department of Navy. Joe has been responsible for executing efforts across the West coast and Department of Navy in advanced analytics that have included the application of data science, AI, and robotic process automation (RPA) that resulted in significant insights and organization efficiencies. Additionally, Joe leads The Data Science Bowl®, presented by Booz Allen and Kaggle. This is the world's premier data science for social good competition. The 90-day online event brings together more than 27,000 data scientists, technologists, domain experts and organizations to generate solutions for the world's most pressing problems, such as human diseases, ocean health, and early childhood education.

SOURABH SAPTARSHI is a currently enrolled Mechanical Engineering graduate student from North Carolina State University, NC, with ongoing research in metal additive manufacturing. He worked for a few years as a Development Engineer at Sumitomo Rubber, USA before returning back to academia to pursue a long-standing interest in 3D printing. His current research is into electrical conductivity of additively manufactured copper parts and Microstructure Optimization of Oxide Dispersion Strengthened Steel. His research interests are in the field of material and process development for new materials for additive manufacturing, FEA, and optimizing electrical conductivity of additively manufactured copper parts.

DYLAN SCHMORROW, PH.D., chief scientist at Soar Technology, Inc., leads the advancement of research and technology tracks to build intelligent systems for defense, government, and commercial applications that emulate human decision making in order to make people more prepared, more informed, and more capable. He also serves as a Potomac Institute for Policy Studies Senior Fellow, Editor of the *Theoretical Issues in Ergonomics Journal*, and the technical advisor for the Applied Human Factors and Ergonomics Conference Series. He is one of the nation's leading experts on national security research, technology, and policy related to information technology, medical research and human performance applications. Past service includes OSD, DARPA, NAWC, NRL, ONR, Naval Postgraduate School, and Executive Assistant to the Chief of Naval Research. Dr. Schmorrow holds a Ph.D. in Experimental Psychology from Western Michigan University, as well as M.S. degrees in Psychology and Philosophy. He retired from the U.S. Navy as a Captain in 2013, after 20 years of service.

ROGER SMITH, PH.D., has over 25 years of experience creating leading-edge simulators for the Department of Defense and Intelligence Community. He is a senior scientist with Soar Technology, Inc. working on AI applications to cyber and social media training simulation problems. He was previously the chief engineer for the Army's $100 million Synthetic Training Environment (STE) project, overseeing the work of the entire engineering team. He served as the chief technology officer for the U.S. Army PEO for Simulation, Training, and Instrumentation (STRI) where he identified important new technologies that would be leveraged in future Army training systems. Dr. Smith was the VP and CTO for training systems for Titan Corp and BTG Inc. prior to their acquisition by L-3 and subsequent merger to form L3Harris. His work there primarily focused on the intelligence community. He began his career performing operations research studies and developing software to support Lockheed Martin's F-16 program. He holds a Ph.D. in Computer Science, an M.S. in Statistics, and a B.S. in Applied Mathematics. He has published 3 professional textbooks on simulation, 17 book chapters, and over 100 journal and conference papers. His most recent book is "Thinking About Innovation". He has received awards/recognition from the U.S. Army, NSA, Association for Computing Machinery, Society for Computer Simulation, and AFCEA.

ROBERT SOTTILARE, PH.D., is the Director of Learning Sciences at Soar Technology, Inc. and Chairman of the Board for the not-for-profit Adaptive Instructional Systems (AIS) Consortium. He has nearly 40 years of experience as a researcher, developer and evaluator of instructional technology and training systems. His experience spans government (U.S. Army and Navy science & technology organizations), industry and academia. His recent research has focused on adaptive instruction including learner and team modeling, automated authoring tools, AI-based real-time instructional management, and evaluation methods for intelligent tutoring systems (ITSs). At the U.S. Army Research Laboratory, he founded and led the adaptive training science & technology program and is the father of the award-winning Generalized Intelligent Framework for Tutoring (GIFT), an adaptive instructional architecture. Dr. Sottilare is

AUTHOR BIOGRAPHIES

widely published with over 240 technical papers with over 2500 citations. He has a long history as a leader, speaker and supporter of learning sciences. He is a senior member of the IEEE and founding Chair of the IEEE AIS Working Group, Chair of the HCII AIS Conference and is a former Program Chair of the Defense & Homeland Security Simulation Conference. Dr. Sottilare is an associate editor for the IEEE Transactions on Learning Technologies Journal and has been a member of the AI in Education Society, the Florida AI Research Society, the IEEE Computer Society, the IEEE Standards Association, the National Defense Industry Association and the National Training Systems Association. He is a faculty scholar and formerly taught graduate level courses on ITS theory and design. He was also an appointed visiting lecturer at the United States Military Academy where he taught a senior level colloquium in adaptive training methods and ITS design. Dr. Sottilare earned a patent (#7,525,735) for a high resolution, head mounted projection display using virtual target technologies to support virtual, live (embedded) and augmented reality training. He is a recipient of the U.S. Army Meritorious Service Award (2018), the U.S. Army Achievement Medal for Civilian Service (2008), the National Training & Simulation Association (NTSA) Team Award for Education & Human Performance (2019) for his contributions to GIFT, and two lifetime achievement awards in Modeling & Simulation: U.S. Army RDECOM (2012; inaugural recipient) and the NTSA Governor's Award (2015). He recently won best tutorial for his short course on the "Fundamentals of Adaptive Instruction" at the 2020 Interservice/Industry Training, Simulation & Education Conference (IITSEC).

ANDREW D. STEWART is a National Security and Government Senior Strategist for Cybersecurity at Cisco Systems, Inc. He has been with Cisco for the last 3 years after retiring from almost 30 years in the U.S. Navy where he last served as the Chief of Cyber Operations for Fleet Cyber Command/U.S. TENTH Fleet. He also served as the Commanding Officer and Program Manager of the Navy Cyber Warfare Development Group (NCWDG). He is a graduate of the Sellinger School of Business, Loyola University Maryland and the Cybersecurity and Policy Executive Program from the Harvard Kennedy School. He is also a graduate from the Naval Postgraduate School Monterey, CA, the United States Naval Academy, the National Defense University, and the Naval War College.

ART WERKENTHIN, CEO of RISC, Inc, has over 30 years' experience working with learning management systems (LMS). As an early xAPI enthusiast, Art led RISC to be the first to implement xAPI 1.0 in a commercial LMS. Since 2012, he has been an active participant on the ADL cmi5 committee. Art frequently presents and authors blog articles on both xAPI and cmi5 topics. RISC was also the first to implement cmi5 in an LMS in July of 2016. Art developed an open source cmi5 "AU Simulator" that can be used to test LMS implementations of cmi5. In addition, he developed the open source cmi5 client library for ADL in 2019. Art provides cmi5 consulting to both Learning & Development professionals and content tool vendors.

DAN WOJCIECHOWSKI spent over 29 years designing carrier grade wireless and wireline telecommunications equipment. Since then, he has spent 6 years in the Cyberspace Solutions organization of CACI performing cybersecurity analysis of commercial networking and software products as well as designing portions of CACI's LiveRAN product for bit-accurate, real-time modeling and simulation of wireless core networks. Mr. Wojciechowski holds a Masters Degree in Electrical Engineering from the University of Illinois and shares a patent for enhancing cybersecurity via software diversification.

SIMONE M. YOUNGBLOOD is a member of the Johns Hopkins Applied Physic Laboratory's Principal Professional Staff. Leveraging an extensive background in simulation development and credibility assessment, Simone Youngblood has served as the DoD VV&A focal point for the past 25 years. Ms. Youngblood was the editor of the *DoD VV&A Recommended Practices Guide* and chaired the development of several VV&A related standards including: IEEE Standard 1278.4, IEEE Standard 1516.4 and MIL-STD 3022. Ms. Youngblood has served as the V&V and/or accreditation agent for numerous M&S efforts that span a broad organizational spectrum to include: PEO IWS 1, the Defense Threat Reduction Agency (DTRA), the Domestic Nuclear Detection Office (DNDO), the U.S. Naval Air Systems Command, and the U.S. Army Medical Research and Material Command. Ms. Youngblood has a B.A. in Mathematics as well as B.S. and M.S. degrees in Computer Science.

PAPERS

ROOM	SESSION/CHAIR	1400	1430	1500
320A	**ECIT1: Emerging Concepts in VR** Chair: Paul Bogard	21122 Building Performant VR Applications for Multi-Domain Modeling and Simulation	21162 Adapting Flight Training Device Visual System Testing Methods to Extended Reality Near-Eye Displays	21218 Development of an Immersive Virtual Reality Trainer for Diving Teams
320B	**TRN1: Adapting Training to Reality** Chair: Julie Kent	21226 Training for Stressful Operations using Adaptive Systems: Conceptual Approaches and Applications	21280 Leveraging Legacy Training in Modern Systems: Framework and Implementation	21308 Objective Neurological Measurement for Learning: A Review
320C	**SIM1: AI Contributions to Advanced Training Simulation** Chair: Nina Deibler	21253 Growing People: Generating Realistic Populations and Explainable, Goal Directed Behavior	21257 Physics-based Real-time Dynamic Generation of Temporal Energy Maps for Virtual Training in Realistic IR Sensor Simulators	21180 Are We Machine Learning Yet? Computer Generated Forces with Learning Capabilities in Military Simulation
320D	**ED1: Levelling Up: Instructional Models for the New (Un)Normal** Chair: Judy Katz	21164 Upskilling: A Necessary and Misunderstood Part of Digital Transformation	21186 Adapting Best Practices for Peer Assessments in Army Training	21236 The SIM: A Simple Instructional Model for Developing Instructor Competence in the use of Extended Reality Technologies
320E	**PSMA1: Lock it Down: Validating and Securing the Future of Training** Chair: Mindy Hoover, Ph.D.	21184 Virtual Worlds Need REAL Governance of Privacy and Safety	21213 A Framework for the Accreditation of Simulation-Based Experiments	21265 'In through the Out Door' – Security and Identity Concerns for Military Digital Twins
320F	**HPAE1: Augmenting Technology to Positively Impact Medical Outcomes** Chair: Christine Allen, Ph.D., CMSP	21188 Objective Pain Identification and Monitoring for Fighter Pilots	21198 Using a Mobile Health (mHealth) System to Mitigate Posttraumatic Stress Disorder (PTSD) and Other Consequences of War	21374 Enhancing Maintenance Workers: A Controlled Field Experiment with Augmented Reality

ROOM	SESSION/CHAIR	1600	1630	1700
320A	**ECIT2: Virtual and Mixed Reality Healthcare Initiatives** Chair: M. Beth Pettitt, Ph.D.	21193 Volumetric Video and Mixed Reality for Healthcare Training	21251 nXcomms: Developing the Intelligent Patient Simulation Platform	
320B	**TRN2: Improving Aviation Training on Three Continents** Chair: Perry McDowell	21113 Augmenting Pilot Training through a Non-invasive Eye-tracking System	21119 Design of a Reference Training for Simulator Specification and Syllabi Optimization for the Defence Helicopter Command	21381 Improving Learning After the Accident: VR & Aviation Mishap Education
320C	**SIM2: Globally Oriented Augmented Training and Simulation** Chair: Ray Compton	21109 Agent Based Simulation of Naval Tactics with Effectiveness Analysis Features	21137 3D User Interfaces for Public Safety: Addressing Fidelity in Virtual Testbed Development	21159 Logistic Simulation to Support Military Rescue Chains
320D	**ED2: Games, Hacking, and VR: Oh My!** Chair: Tim Cooley	21299 Not Always Fun and Games: Challenges to Classroom Implementation of a Serious Game	21376 A Novel Ethical Hacking Teaching Model: A Systematic Approach to Learn Cyber Attack Methods	
320E	**PSMA2: Improving Training, Simulation & Education Through Interoperability Standards** Chair: Scott Johnston	21273 Bring Live Sensors to the Virtual Training Environment Via DIS	21274 SISO C-DIS Techniques and Performance	21322 Ultra-Low Latency Messages Over WAN for Training Using Open Standards
320F	**HPAE2: Trust and Automation** Chair: Jeffrey Raver	21284 A Multi-Domain Robotic Teammate Framework: Next Generation Human-Machine Interface Principles to Support Trust and Mission Outcomes	21377 Trust Exercises and Automation Transparency: The Big Fish	

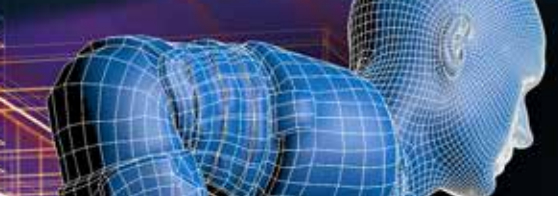
ROOM	SESSION/CHAIR	0830	0900	0930
320A	**ECIT3: Digital Twins: Sleight of Hand or Real Magic?** Chair: Simon Skinner	21163 Distributed LVC Based Testing Using a Hybrid Digital Twin	21243 Hardening Mission Operations Against Cyber Threats	21300 Digital Twins to Computer Vision: A Rapid Path to Augmented Reality Object Detection on the Battlefield
320B	**TRN3: AR/VR is it Real...** Chair: Robert Wallace	21173 Scanning Analysis of Novice and Experienced Hoist Operators: Simulation Using a Virtual Reality Hoist Training System	21360 Adapting a Sports Research Method to Accelerate Rapid Reaction Skills in Military and Law Enforcement	
320C	**SIM3: Cyberspace Solutions for Multi-Domain Operations** Chair: Mike Fagundes	21244 Using Cyberspace Electromagnetic Activities M&S for Multi-Domain Operations Challenges	21258 A Cyberspace Effects Server for LVC&G Training Systems	
320D	**ED3: wikiHow: The Underpinnings of Automated Assessment** Chair: Stu Armstrong	21177 Bridging the SCORM and xAPI Gap: The Role of cmi5	21259 Adaptive Assessment Feedback in Competency Based Learning Ecosystems	21270 How to Build Adaptive Training Amid a Future of Uncertainty
320E	**PSMA3: Interoperability: Get it Together** Chair: Heath Morton	21325 NGA's Approach to Address M&S Interoperability	21359 Beyond Innovation and Implementation: Sustaining Technology Transformation	21247 Interoperability: Tool to Assess for Multinational Live Training
320F	**HPAE3: Designing, Guiding, and Evaluating Training** Chair: Thomas Kehr	21149 Army Training and Talent Management: Finding Developmental Leverage in the Rediscovery of the Instructional Systems Specialist	21154 Closing the Contextual and Chronological Gap: An HPT Tool for the Selection of Learning and Performance Support Interventions	21298 Evaluating Fidelity for Tactical Training within the Live-Virtual Constructive Environment

ROOM	SESSION/CHAIR	1030	1100	1130
320A	**ECIT4: Data Architecture for Tomorrow's Analytics** Chair: Tyson Kackley	21358 Total Learning Architecture Data Model for Analytics and Adaptation	21151 Developing a Scalable Data Analytics Pipeline	21241 Streamlining 3D Data Integration with Standardized Web APIs
320B	**TRN4: Learner-centered Training in Defense** Chair: Heather Oonk	21246 Lessons Learned for Implementing Adaptive Blended Learning Experiences Using Moodle	21222 Enhancing Military Exercise Team Performance with Diversified xAPI Instrumented eLearning	21120 Personalisation of Learning: Developing the Case for Implementation Within Defence Learning Establishments
320C	**ECIT5: Under the Hood** Chair: Jeremy Lanman, Ph.D.	21230 Integrating 5G Capability into Marine Corps Live-Virtual-Constructive Prototyping and Experimentation	21318 Radio Access Network (RAN) Standard for potential use in the Synthetic Training Environment (STE)	21111 Blockchains for Achieving Data Awareness and Enabling Data Sharing
320F	**HPAE4: Simulations Drive Decisions** Chair: Jason Bewley	21189 Skill Acquisition and Decay in Aircraft Carrier Landings	21205 Testing Simulation Platforms to Accelerate Optimal Military Decision-Making	21233 Operationalizing Artificial Intelligence in Simulation Based Training
320GH	**Best Paper Session 1** Chair: Brian Stensrud, Ph.D.	21310 **SIM:** Simulation for Women, Peace and Security Training	21301 **PSMA:** Gender Equity in an Evolving Work Environment	21229 **ED:** Form from Function: Applying Flow Driven Experiential Learning to the Integration of Immersive Technology in Formal Military Aviation Training Programs

PAPERS

ROOM	SESSION/CHAIR	1400	1430	1500
320C	**SIM4: Integrated Creative Terrain Simulation** Chair: Tara Kilcullen	21123 Advanced Real-Time Radar Simulation: Maintaining Range Resolution for Large-Area Ground Maps	21139 Ground Material Segmentation for UAV-based Photogrammetric 3D Data: A 2D-3D Hybrid Approach	21366 Rapid Prototyping for Simulation and Training with the Rapid Integration & Development Environment (RIDE)
320D	**ED4: Hard Work Never Killed Anyone, But Why Take the Chance?** Chair: Marryam Chaudhry	21216 VR Story-Experiencing: Vivifying Diversity & Inclusion Training for Military Leaders	21224 Assessing Employee Risk Due to Exposure to Hazards with a VR Simulator	21227 Workforce Training for Optics and Photonics Manufacturing Using Desktop VR Simulations, Data Visualization, and Game-Based Learning
320GH	**Best Paper Session 2** Chair: Jimmy Moore, CMSP	21207 **ECIT:** Optimizing Optimizations: a Two-Stage Neural Network Approach for Leveraging Optimality in Time-Sensitive Solutions	21136 **HPAE:** Augmented Reality in Tactical Combat Casualty Care: Physiological Ramifications	21103 **TRN:** Attention and Engagement in Virtual Environments: Measuring the Unobservable

ROOM	SESSION/CHAIR	1600	1630	1700
320A	**ECIT6: Advanced Model Academy** Chair: Marcus Boyd	21101 Gamifying M&S Transportation Education & Training to Improve Engineering Learning Outcomes	21285 CrowdSim: A Generative Model of Crowd Knowledge and Responses	21307 Code Generation of Simulation Models for the U.S. Army's Synthetic Training Environment
320B	**TRN5: Training Enhancement through Data Analytics** Chair: Liz Gehr, Ph.D.	21332 Forging Competency and Proficiency through the Synthetic Training Environment with an Experiential Learning for Readiness Strategy	21330 Data, What Is It Good For? We Don't Know!	21238 Providing Better Feedback to Aviators through Automated Human Performance Analysis
320C	**SIM5: Amplifying Outcomes by Improving Existing Technology** Chair: Christina Welch, Ph.D.	21104 Developing a Multilingual Auto-coding Interface Control for the MAVERIC-II Dynamics Simulator	21155 An Augmented Reality Thunderstorm Simulation to Improve Aviation Weather Pilot Training	21206 Environment Extension: A Passive Interactivity Approach to Immersive AR/MR
320D	**ED5: Flippin' Learning Rocks the Schoolhouse!** Chair: William Gerber	21132 Digital Learning Resources Will Not Make Teachers Obsolete, but What about the Classroom Lecture?	21131 Blended and Adaptive Learning in Ground School Instruction for Aviators	
320E	**PSMA4: Applying Methodologies to Capabilities & Systems** Chair: Rhianon Dolletski-Lazar	21145 Applying the Systems Engineering Construct to Medical Simulation Development	21178 Implementing Agile for Training Development to Support Rapid Capability Deployment	21192 Scaling Software Acquisition Pathway to Manage a Portfolio of Systems



ROOM	SESSION/CHAIR	0830	0900	0930
320A	**ECIT7: Machine Learning in the Wild: Applications, Approaches, and Lessons Learned** Chair: Brian Stensrud, Ph.D.	21176 Yes I Speak… AI Neural Machine Translation in Multi-Lingual Training	21283 Augmenting OneWorld Terrain (OWT) Data with Civilian Infrastructure by Using Machine Learning Techniques	21150 Using Machine Learning for Battle Management Analysis
320B	**TRN6: Simulation Design** Chair: Nir Keren, Ph.D.	21110 An Emulation of a Flying Boom Operator Using a Rule-Based Expert System	21350 Interplay to Facilitate Decision-Making Under Uncertain Maritime Operations	
320C	**SIM6: Improving Warfighter Training with Simulation** Chair: Paul Andrzejewski	21315 Improved Air-Ground Simulation Training with Future Integrated Training Environments (FITE) in XCD	21333 Improved Small Unit Maneuver via Pre-Operation Simulation	21340 Technology for an Affordable Augmented Reality Fire Support Team Trainer
320D	**ED6: Scaffolding the Future: Contested and Complex Battlespace** Chair: Brian Overy	21267 Case Studies: Ensuring Objective, Consistent, and Actionable Evaluation of Simulation	21269 There's no "I" in HAT: Identifying Appropriate Skills for Human Agent Teaming of Varying Levels of Autonomy and Embodiment	21223 Estimating Learner Ability with Item Response Theory
320E	**PSMA5: Taking the Guesswork Out of ROI** Chair: James Dennis	21319 Breaking the Iron Triangle with Commercial Technology Insertion	21197 "Saving Lives" is Priceless: Pinpointing ROI for Medical Training	21254 Business Challenges Faced by Modelling and Simulation Defence Cloud Systems
320F	**HPAE5: Teamwork Makes the Dream Work** Chair: Randy Jensen	21158 Teamwork Assessment and Development: Methodological Challenges and Solutions	21314 Measures for Assessing Command Staff Team Performance in War-gaming Training	

ROOM	SESSION/CHAIR	1030	1100	1130
320A	**ECIT8: Countering Adversarial Physical and Technological Access** Chair: Chuck Breed	21146 Solving Privacy Issues in Impostor Detection Training with AI Generated Artificial Face Images	21168 Computer Vision Aided Unexploded Ordnance (UXO) Detection using Synthetic Data	
320B	**TRN7: Designing the Future of Training** Chair: Mark Parsons	21121 Accelerating Marine Corps Training Through Innovation	21165 Modular and Multimodal: Delivering Distributed and Scalable Technical Training	21295 Bringing the Debrief into Three Dimensions with Augmented Reality
320C	**ECIT9: Technology Buffet** Chair: Brian Stensrud, Ph.D.	21187 AI: The End of the World...of Work?	21191 Lessons from the Front Lines: A Modular Open Systems Approach to a Training Ecosystem	21167 Creating Immersive Virtual Training Scenarios from 2D Inputs Using Artificial Intelligence
320D	**TRN8: Social Interactions** Chair: Julie Kent	21171 Learner Feedback as Collaborative Problem Solving	21329 Perceptions of the Use of Synthetic Crewmembers in Aircrew Training: Instructor and Student Perspectives	21380 Adapting Tactic Fire-Control for Indirect Fire Weapons in Live Training

ROOM	SESSION/CHAIR	1330	1400	1430
320A	**ECIT10: AI and Its Applicability for Simulations** Chair: Joe Mercado	21278 Evaluating the Effectiveness of AI in Training Simulations	21199 Evolved AI for Model-based Reinforcement Learning	21143 Enhancing Operations by Applying Constructive Simulation and Artificial Intelligence
320B	**TRN9: Optimizing AR for Medical Training** Chair: Alexandra Steiner	21133 Optimal Use of Immersive Technologies for Critical Decision-Making Instruction	21147 Examining Technology, Human, and Contextual Factors Impacting AR Utility for Learning	21169 Usability Evaluation of Augmented Reality Training for Battlefield Care Tasks

PAPERS

BEST PAPERS

BP1 — 1 DECEMBER • 1030 • ROOM 320GH

Session Chairs: Brian Stensrud, Ph.D., Soar Technology, Inc.
Mark Parsons, SAIC

21310 SIM: Simulation for Women, Peace and Security Training
Neil Sleevi, Threattec, LLC; Melvin Cape, TRADOC G-2, Modeling and Simulation Office (M&SO) and Operational Environment Laboratory (OEL); Jumanne Donahue, CGI Federal / TRADOC G-2 M&S; LisaRe Babin, The Army University / Directorate of Academic Affairs; Shanda Lauer, The Army University / Institutional Research and Assessment Division; Heath (Hank) Brightman, U.S. Naval War College

21301 PSMA: Gender Equity in an Evolving Work Environment
Nina Deibler, Susan Hartman, Jeffrey Coulter, Serco

21229 ED: Form From Function: Applying Flow Driven Experiential Learning to the Integration of Immersive Technology in Formal Military Aviation Training Programs
Nancy Taylor, USAF; Andrew Clayton, Ph.D., Air University

BP2 — 1 DECEMBER • 1400 • ROOM 320GH

Session Chair: Jimmy Moore, CMSP, PeopleTec
Session Deputy: Mark Covey, Krush Acquisitions

21207 ECIT: Optimizing Optimizations: A Two-Stage Neural Network Approach for Leveraging Optimality in Time-Sensitive Solutions
Matthew McLaughlin, Fires Battle Lab

21136 HPAE: Augmented Reality in Tactical Combat Casualty Care: Physiological Ramifications
Kay Stanney, Claire Hughes, Cali Fidopiastis, Design Interactive, Inc.; Angelica Jasper

21103 TRN: Attention and Engagement in Virtual Environments: Measuring the Unobservable
Benjamin Bell, Elaine Kelsey, Eduworks; Benjamin Nye, USC ICT; Wink Bennett, Airman Systems Directorate, Warfighter Readiness Research Division

EDUCATION

ED1 — 30 NOVEMBER • 1400 • ROOM 320D

LEVELING UP: INSTRUCTIONAL MODELS FOR THE NEW (UN)NORMAL

Session Chair: Judy Katz, Eduworks Corporation
Session Deputy: Sandra Velez, Arorae Corporation

21164 Upskilling: A Necessary and Misunderstood Part of Digital Transformation
Lara Bove, Anne Little, Ph.D., SAIC

21186 Adapting Best Practices for Peer Assessments in Army Training
Elizabeth Uhl, U.S. Army Research Institute; Ronelle Koschny, Consortium of Universities of the Washington Metropolitan Area; Tatiana Toumbeva, Aptima, Inc.; Ashley Wittig, U.S. Army Research Institute; Celeste Sanders, Army Research Institute; Frederick Diedrich, Ph.D., Independent Consultant; Scott Flanagan; Sophia Speira

21236 The SIM: A Simple Instructional Model for Developing Instructor Competence in the use of Extended Reality Technologies
Zachary Jaeger, USAF

ED2 — 30 NOVEMBER • 1600 • ROOM 320D

GAMES, HACKING, AND VR: OH MY!

Session Chair: Tim Cooley, Dynamx Consulting
Session Deputy: Jennifer Winner, USAF

21299 Not Always Fun and Games: Challenges to Classroom Implementation of a Serious Game
Jana Willis, University of Houston-Clear Lake; Monica Trevathan, Curriculum & Instruction Services, LLC

21376 A Novel Ethical Hacking Teaching Model: A Systematic Approach to Learn Cyber Attack Methods
Jason Cuneo, Daniel Tauritz, David Umphress, Auburn University

ED3 — 1 DECEMBER • 0830 • ROOM 320D

WIKIHOW: THE UNDERPINNINGS OF AUTOMATED ASSESSMENT

Session Chair: Stu Armstrong, Cole Engineering Services, Inc.
Session Deputy: James Frey, Ph.D., JANUS Research Group

21177 Bridging the SCORM and xAPI Gap: The Role of cmi5
Brian Miller, Tammy Rutherford, Alicia Pack, Rustici Software; Andy Johnson, Advanced Distributed Learning (ADL) Initiative (SETA Contractor)

21259 Feedback in Competency Based Learning Ecosystems
Jessica Johnson, Katherine Smith, Old Dominion University–VMASC; Ted Dennis, Greg Jimenez, TEDtext, LLC; Rafael Diaz, Virginia's Modeling, Analysis & Research Center

21270 How To Build Adaptive Training Amid A Future of Uncertainty
Laura Bohnert, Modest Tree

ED4 — 1 DECEMBER • 1400 • ROOM 320D

HARD WORK NEVER KILLED ANYONE, BUT WHY TAKE THE CHANCE?

Session Chair: Marryam Chaudhry, XR2LEAD
Session Deputy: Josh Looper, USAF

21216 VR Story-Experiencing: Vivifying Diversity & Inclusion Training for Military Leaders
Jason Noren, Jennifer Cameron, Matthew Koval, Booz Allen Hamilton

21224 Assessing Employee Risk Due to Exposure to Hazards with a VR Simulator
Nir Keren, Ph.D., Tavion Yrjo, Alon Klekner, Peter Evans, David Dehass, Iowa State University

21227 Workforce Training for Optics and Photonics Manufacturing Using Desktop VR Simulations, Data Visualization, and Game-Based Learning
Erik Verlage, Glenda Stump, Saif Rayyan, Sajan Saini, George Westerman, Lionel Kimerling, Massachusetts Institute of Technology; Bhargav Upadhyay, Jeff Bertrand, Kapil Madathil, Clemson University; Alan Kost

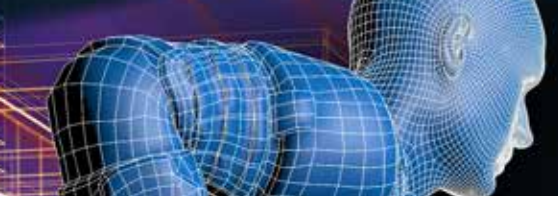
ED5 — 1 DECEMBER • 1600 • ROOM 320D

FLIPPIN' LEARNING ROCKS THE SCHOOLHOUSE!

Session Chair: William Gerber, Institute for Defense Analyses (IDA)
Session Deputy: Mike Thorpe, Serco, Inc.

21132 Digital Learning Resources Will Not Make Teachers Obsolete, But What About the Classroom Lecture?
Geir Isaksen, Norwegian Defense University College/ADL Office

21131 Blended and Adaptive Learning In Ground School Instruction for Aviators
Patrick Craven, Ph.D., CHFP, Lockheed Martin Corporation Orlando



ED6 2 DECEMBER • 0830 • ROOM 320D

SCAFFOLDING THE FUTURE: CONTESTED AND COMPLEX BATTLESPACE

Session Chair: Brian Overy, Aechelon Technology
Session Deputy: Jennifer McArdle, CMSP, Improbable

21267 Case Studies: Ensuring Objective, Consistent, and Actionable Evaluation of Simulation
Murray Goldberg, Marine Learning Systems; Arvinder Aujla

21269 There's No "I" in HAT: Identifying Appropriate Skills for Human Agent Teaming of Varying Levels of Autonomy and Embodiment
Summer Rebensky, Daniel Nguyen, Kendall Carmody, Cherrise Ficke, Meredith Carroll, Florida Institute of Technology; Wink Bennett, Airman Systems Directorate, Warfighter Readiness Research Division

21223 Estimating Learner Ability with Item Response Theory
Stephen Gunter, Ph.D., Jeffrey Beaubien, Ph.D., Aptima, Inc.

EMERGING CONCEPTS & INNOVATIVE TECHNOLOGIES

ECIT 1 30 NOVEMBER • 1400 • ROOM 320A

EMERGING CONCEPTS IN VR

Session Chair: Paul Bogard, Air Force Life Cycle Management Center, Simulators Program Office
Session Deputy: Deri Draper-Amason, VMASC

21122 Building Performant VR Applications for Multi-Domain Modeling and Simulation
Josh Klint, Leadwerks Software; Doyle Towles, Peraton, Ben Gavares, Michael Juliano, Northrop Grumman

21162 Adapting Flight Training Device Visual System Testing Methods to Extended Reality Near-Eye Displays
Benito Graniela, Naval Air Warfare Center Training Systems Division (NAWCTSD); Robert Calvillo; Naval Air Systems Command

21218 Development of an Immersive Virtual Reality Trainer for Diving Teams
Robert Guest, Modux; Thomas Govan, NSC

ECIT 2 30 NOVEMBER • 1600 • ROOM 320A

VIRTUAL AND MIXED REALITY HEALTHCARE INITIATIVES

Session Chair: M. Beth Pettitt, Ph.D., CCDC Soldier Center, STTC
Session Deputy: Ashley Howell, Advanced Distributed Learning (ADL) Initiative

21193 Volumetric Video and Mixed Reality for Healthcare Training
Matthew Hackett, Ph.D., Basiel Makled, U.S. Army DEVCOM-SC STTC; Elliot Mizroch, Simon Venshtain, 8i

21251 nXcomms: Developing the Intelligent Patient Simulation Platform
Jerry Heneghan, Brandon Conover, Ph.D., Christine Heneghan, Chris Wall, Jason Cisarano, Wesley Pretsch, BioMojo, LLC; William Vasios, III, WV3 LLC; Gene Hobbs, University of North Carolina School of Medicine; Robert Hubal, University of North Carolina

ECIT 3 1 DECEMBER • 0830 • ROOM 320A

DIGITAL TWINS: SLEIGHT OF HAND OR REAL MAGIC?

Session Chair: Simon Skinner, Thales Training and Simulation
Session Deputy: Fuzzy Wells, Ph.D., CMSP, The MITRE Corporation

21163 Distributed LVC Based Testing Using a Hybrid Digital Twin
Michael O'Connor, CMSP, Trideum; Kenneth LeSueur, Brett Boren, U.S. Army Redstone Test Center

21243 Hardening Mission Operations Against Cyber Threats
Lloyd Wihl, Jeffrey Weaver, Ph.D., SCALABLE Network Technologies

21300 Digital Twins to Computer Vision: A Rapid Path to Augmented Reality Object Detection on the Battlefield
Chuck Wythe, Nosika Fisher, Cape Henry Associates, Inc.; Brandon Russell; Jeremy Alessi, Midnight Status; Chris Gallagher; Joel Throckmorton, KOVA Global, Inc.; Sergey Bobrov

ECIT 4 1 DECEMBER • 1030 • ROOM 320A

DATA ARCHITECTURE FOR TOMORROW'S ANALYTICS

Session Chair: Tyson Kackley, MCSC, PM Wargaming Capability
Session Deputy: Kent Gritton, Navy

21358 Total Learning Architecture Data Model for Analytics and Adaptation
Brent Smith, Sae Schatz, Ph.D., Advanced Distributed Learning (ADL) Initiative; John Turner, Office of the Chief Data Officer

21151 Developing a Scalable Data Analytics Pipeline
Patrick Rupp, Anastacia MacAllister, Ph.D., Jason Garrison, George Hellstern, Lockheed Martin Corporation; Daniel Javorsek, Nellis AFB; Philip Chu, DARPA

21241 Streamlining 3D Data Integration with Standardized Web APIs
Ingo Simonis, Melisa Harder, Open Geospatial Consortium

ECIT 5 1 DECEMBER • 1030 • ROOM 320C

UNDER THE HOOD

Session Chair: Jeremy Lanman, Ph.D., PEO STRI
Session Deputy: Chuck Wythe, Cape Henry Associates

21230 Integrating 5G Capability into Marine Corps Live-Virtual-Constructive Prototyping and Experimentation
Jeff Hoyle, Ha Duong, SCALABLE Network Technologies

21318 Radio Access Network (RAN) Standard for potential use in the Synthetic Training Environment (STE)
Nicholas Tenn, TITENN, Inc.; Frank Tucker, U.S. Army Combat Capabilities Development Command - Soldier Center; Brian Kemper, PEO STRI; Brian Holmes, ManTech International Corporation; Glenn Martin, UCF Institute for Simulation and Training

21111 Blockchains for Achieving Data Awareness and Enabling Data Sharing
Robert Siegfried, Ph.D., Torsten Müller, Aditerna; Hilmar Holland, Mario Pehla (German Air Force)

ECIT 6 1 DECEMBER • 1600 • ROOM 320A

ADVANCED MODEL ACADEMY

Session Chair: Marcus Boyd, L3Harris Link Training & Simulation
Session Deputy: Justin Fessler, Salesforce

21101 Gamifying M&S Transportation Education & Training to Improve Engineering Learning Outcomes
Kevin Hulme, Ph.D., CMSP, The Stephen Still Institute for Sustainable Transportation and Logistics (SSISTL); Rachel Su Ann Lim, Stephen Still, Aaron Estes, Mark Schiferle, University at Buffalo

21285 CrowdSim: A Generative Model of Crowd Knowledge and Responses
Leonard Eusebi, Michael Lepori, Jr., Sean Guarino, Charles River Analytics

21307 Code Generation of Simulation Models for the US Army's Synthetic Training Environment
Scott Gallant, Effective Applications; Christopher McGroarty; Keith Snively, Dynamic Animation Systems, Inc.; Jim Gallogly, Cole Engineering; Anup Raval, Dynamic Animation Systems

ECIT 7 — 2 DECEMBER • 0830 • ROOM 320A

MACHINE LEARNING IN THE WILD: APPLICATIONS, APPROACHES, AND LESSONS LEARNED

Session Chair: Brian Stensrud, Ph.D., Soar Technology, Inc.
Session Deputy: Neil Stagner, Marine Corps Systems Command

21176 Yes I Speak… AI Neural Machine Translation in Multi-Lingual Training
Péter Orynycz, Tom Dobry, Angela Jackson, Kourtni Litzenberg, Antech Systems, Inc.

21283 Augmenting OneWorld Terrain (OWT) Data with Civilian Infrastructure by Using Machine Learning Techniques
Matthew Rolfe, Freddie Santiago, Dartangan Jackson, Dignitas Technologies

21150 Using Machine Learning for Battle Management Analysis
Anastacia MacAllister, Ph.D., Patrick Rupp, George Hellstern, Jason Garrison, Lockheed Martin Corporation; Daniel Javorsek, Nellis AFB; Philip Chu, DARPA

ECIT 8 — 2 DECEMBER • 1030 • ROOM 320A

COUNTERING ADVERSARIAL PHYSICAL AND TECHNOLOGICAL ACCESS

Session Chair: Chuck Breed, Zenetex LLC - Training Division
Session Deputy: Evan Oster, Aptima, Inc.

21146 Solving Privacy Issues in Impostor Detection Training with AI Generated Artificial Face Images
Costas Koufogazos, Jesse Flint, Nick Brawand, Design Interactive, Inc.

21168 Computer Vision Aided Unexploded Ordnance (UXO) Detection using Synthetic Data
Russell Craig, Joseph Mercado, Unity Technologies; Chris Kawatsu, Ben Purman, Soar Technology, Inc.

ECIT 9 — 2 DECEMBER • 1030 • ROOM 320C

TECHNOLOGY BUFFET

Session Chair: Brian Stensrud, Ph.D., Soar Technology, Inc.
Session Deputy: Ashley Howell, Advanced Distributed Learning (ADL) Initiative

21187 AI: The End of the World...of Work?
David Noever, Joseph Regian, Josh Kalin, Matt Ciolino, PeopleTec

21191 Lessons from the Front Lines: A Modular Open Systems Approach to a Training Ecosystem
Krissa Watry, Christina Padron, Dynepic, Inc.; Margaret Merkle, USAF

21167 Creating Immersive Virtual Training Scenarios from 2D Inputs Using Artificial Intelligence
Larry Moralez, Design Interactive, Inc.

ECIT 10 — 2 DECEMBER • 1330 • ROOM 320A

AI AND ITS APPLICABILITY FOR SIMULATIONS

Session Chair: Joe Mercado, Unity Technologies
Session Deputy: Tim Quiram, FORCECOM Training Division (FC-Td), USCG

21278 Evaluating the Effectiveness of AI in Training Simulations
Robert Sottilare, Ph.D., Christopher Ballinger, Soar Technology, Inc.; Keith Brawner, DEVCOM-Soldier Center

21199 Evolved AI for Model-based Reinforcement Learning
Randal Allen, Ph.D., CMSP, Zachry Engel, Ph.D., Eric Haney, Ph.D., Lone Star Analysis

21143 Enhancing Operations by Applying Constructive Simulation and Artificial Intelligence
Hans-Christian Schmitz, Fraunhofer FKIE; Peter Meyer zu Drewer, CAE

HUMAN PERFORMANCE, ANALYSIS AND ENGINEERING

HPAE1 — 30 NOVEMBER • 1400 • ROOM 320F

AUGMENTING TECHNOLOGY TO POSITIVELY IMPACT MEDICAL OUTCOMES

Session Chair: Christine Allen, Ph.D., CMSP, University of Central Florida Institute for Simulation and Training
Session Deputy: Abhishek Verma, Airbus

21188 Objective Pain Identification and Monitoring for Fighter Pilots
Rebecca Kwasinski, Adam Lynch, Jeff Hullfish, Ph.D., Mitchell Ruble, Ph.D., Brent Winslow, Ph.D., Design Interactive, Inc.; Adam Faurot, SPEAR Human Performance

21198 Using a Mobile Health (mHealth) System to Mitigate Posttraumatic Stress Disorder (PTSD) and Other Consequences of War
Jeff Hullfish, Ph.D., Mitchell Ruble, Adam Lynch, Brent Winslow, Design Interactive, Inc.

21374 Enhancing Maintenance Workers: A Controlled Field Experiment with Augmented Reality
Clay Greunke, Quinn Kennedy, James Fan, Chris Angelopoulos, Naval Postgraduate School; Matt Stone, NAWC/AD; Imre Balogh, Perry McDowell, MOVES Institute

HPAE2 — 30 NOVEMBER • 1600 • ROOM 320F

TRUST AND AUTOMATION

Session Chair: Jeffrey Raver, SAIC
Session Deputy: Sondra Chambers, General Dynamics Information Systems

21284 A Multi-Domain Robotic Teammate Framework: Next Generation Human-Machine Interface Principles to Support Trust and Mission Outcomes
Sandro Scielzo, CAE USA; Donna Kocak, L3Harris Technologies

21377 Trust Exercises and Automation Transparency: The Big Fish
Amanda Bond, Lauren Massey, Soar Technology, Inc.; Emily Anania, John Killilea, Beth Atkinson, Naval Air Warfare Center Training Systems Division; Jacqueline McSorley, Embry-Riddle Aeronautical University; Brian Stensrud, Soar Technology, Inc.

HPAE3 — 1 DECEMBER • 0830 • ROOM 320F

DESIGNING, GUIDING, AND EVALUATING TRAINING

Session Chair: Thomas Kehr, Cole Engineering
Session Deputy: Ronald Ventura-Moore, Maxar

21149 Army Training and Talent Management: Finding Developmental Leverage in the Rediscovery of the Instructional Systems Specialist
Christina Parker, Ed.D., Leonard Momeny, United States Army Aviation Center of Excellence (USAACE)

21154 Closing the Contextual and Chronological Gap: An HPT Tool for the Selection of Learning and Performance Support Interventions
James Knapp, III, U.S. Coast Guard Force Readiness Command

21298 Evaluating Fidelity for Tactical Training within the Live-Virtual Constructive Environment
Barbara Buck, Sarah Davies, Tim Stumpf, Rob Lechner, The Boeing Company; Wink Bennett, Airman Systems Directorate, Warfighter Readiness Research Division

HPAE4 — 1 DECEMBER • 1030 • ROOM 320F

SIMULATIONS DRIVE DECISIONS

Session Chair: Jason Bewley, Applied Training Solutions, LLC
Session Deputy: Andrew Koch, NAWCAD

21189 Skill Acquisition and Decay in Aircraft Carrier Landings
Rocco Panella, Bryan Roberts, BGI

21205 Testing Simulation Platforms to Accelerate Optimal Military Decision-Making
Shane Robinette, Quinn Kennedy, Mollie McGuire, Peter Nesbitt, Naval Postgraduate School

21233 Operationalizing Artificial Intelligence in Simulation Based Training
Tim Cooley, DynamX Consulting; Ivar Oswalt, Ph.D., CMSP, The MIL Corporation

HPAE5 — 2 DECEMBER • 0830 • ROOM 320F

TEAMWORK MAKES THE DREAM WORK

Session Chair: Randy Jensen, Stottler Henke Associates, Inc.
Session Deputy: Susan Harkrider, Modeling and Simulation Division, Night Vision & Electronic Sensors Directorate (NVESD)

21158 Teamwork Assessment and Development: Methodological Challenges and Solutions
Leonie Webster, Ph.D., Abby Laishley, Ph.D., Carole Deighton, Ph.D., Defence Science and Technology Laboratory, UK Ministry of Defence

21314 Measures for Assessing Command Staff Team Performance in War-gaming Training
Grace Teo, Quantum Improvements Consulting; Randy Jensen, Stottler Henke Associate, Inc.; Joan Johnston, DEVCOM Soldier Center Simulation & Training Technology Center (STTC); Jeanine DeFalco, Ph.D., U.S. Army DEVCOM-STTC; Gregory Goodwin, DEVCOM-SC

POLICY, STANDARDS MANAGEMENT AND ACQUISITION

PSMA1 — 30 NOVEMBER • 1400 • ROOM 320E

LOCK IT DOWN: VALIDATING AND SECURING THE FUTURE OF TRAINING

Session Chair: Mindy Hoover, Ph.D., Iowa State University
Session Deputy: Jason Caldwell, Joint Multinational Simulation Center

21184 Virtual Worlds Need REAL Governance of Privacy and Safety
Kavya Pearlman, XR Safety Initiative - XRSI; Joel Scharlat, IVEA Consulting

21213 A Framework for the Accreditation of Simulation-Based Experiments
Thomas Yanoschik, CMSP, SAIC; Christopher Willis, CMSP, Modeling and Simulation Branch, Maneuver Battle Lab

21265 'In through the Out Door' – Security and Identity Concerns for Military Digital Twins
Simon Skinner, Thales Training and Simulation

PSMA2 — 30 NOVEMBER • 1600 • ROOM 320E

IMPROVING TRAINING, SIMULATION & EDUCATION THROUGH INTEROPERABILITY STANDARDS

Session Chair: Scott Johnston, Booz Allen Hamilton
Session Deputy: Marco Lassus, USAF

21273 Bring Live Sensors to the Virtual Training Environment via DIS
Jackie Zhang, Reese Gallagher, Infinitas Engineering, Inc.; Craig Clark, Kratos; Susan Harkrider, Modeling and Simulation Division, Night Vision & Electronic Sensors Directorate (NVESD)

21274 SISO C-DIS Techniques and Performance
Lance Call, AFRL/CAEUSA; Jesse Vater, Cubic Corporation

21322 Ultra-Low Latency Messages over WAN for Training using Open Standards
Jackie Zhang, Reese Gallagher, Infinitas Engineering, Inc.; Craig Clark, Kratos; Robert Proctor Jr., Real-Time Innovations

PSMA3 — 1 DECEMBER • 0830 • ROOM 320E

INTEROPERABILITY: GET IT TOGETHER

Session Chair: Heath Morton, USAF AFMC AFLCMC/EZJS
Session Deputy: Richard Grohs,USAF, HQ ACC/A5T

21325 NGA's Approach to Address M&S Interoperability
Randi Clapham, NGA; Jay Freeman, CAE USA; Charles Jaqueth, Holly Black, CAE MSI

21359 Beyond Innovation and Implementation: Sustaining Technology Transformation
Nicholas Armendariz, Tatana Olson, Erica Harris, U.S. Navy; JJ Walcutt, Ph.D., Clay Strategic Designs

21247 Interoperability: Tool to Assess for Multinational Live Training
Julie Kent, Darian Sablon, Noah Gil, The MITRE Corporation; Paul Smith, PM Soldier Training, PEO STRI

PSMA4 — 1 DECEMBER • 1600 • ROOM 320E

APPLYING METHODOLOGIES TO CAPABILITIES & SYSTEMS

Session Chair: Rhianon Dolletski-Lazar, PEO STRI
Session Deputy: Raquel Fuentes, PEO STRI

21145 Applying the Systems Engineering Construct to Medical Simulation Development
William Pike, Ph.D., U.S. Army DEVCOM-SC STTC; Angela Alban, Edward Stadler, SIMETRI, Inc.

21178 Implementing Agile for Training Development to Support Rapid Capability Deployment
Lauren Blackstone, Gianluca Sirianni, Antech Systems; Jennifer Cameron, Booz Allen Hamilton; Catherine Thistle, NAWCAD WOLF

21192 Scaling Software Acquisition Pathway to Manage a Portfolio of Systems
Lyn Goddard, PEO STRI; Rowland Darbin, General Dynamics Mission Systems

PAPERS

PSMA5 2 DECEMBER • 0830 • ROOM 320E

TAKING THE GUESSWORK OUT OF ROI

Session Chair: James Dennis, ASRC Federal
Session Deputy: Lisa Bair, SAIC

21319 Breaking the Iron Triangle with Commercial Technology Insertion
Joyner Livingston, CMSP, Brian Vogt, CMSP, Jennifer Lewis, CMSP, SAIC

21197 "Saving Lives" is Priceless: Pinpointing ROI for Medical Training
Julie Kent, Ryan Byrne, The MITRE Corporation; Brett Lord, Defense Health Agency

21254 Business Challenges Faced by Modelling and Simulation Defence Cloud Systems
Douglas Henry, Brian Wardman, Dstl, James Kearse, NSC

SIMULATION

SIM1 30 NOVEMBER • 1400 • ROOM 320C

AI CONTRIBUTIONS TO ADVANCED TRAINING SIMULATION

Session Chair: Nina Deibler, Serco
Session Deputy: Robert Sottilare, Ph.D., Soar Technology, Inc.

21253 Growing People: Generating Realistic Populations and Explainable, Goal Directed Behavior
Ashley Fehr, Joseph Stoffa, Improbable; Joshua White, Jared Newton, National Geospatial-Intelligence Agency

21257 Physics-based Real-time Dynamic Generation of Temporal Energy Maps for Virtual Training in Realistic IR Sensor Simulators
Harleen Lappano, Mark Faulk, Cornerstone Software Solutions, Inc.; Joseph Kider Jr., Ph.D., University of Central Florida

21180 Are We Machine Learning Yet? Computer Generated Forces with Learning Capabilities in Military Simulation
Joost van Oijen, Armon Toubman, Royal Netherlands Aerospace Centre

SIM2 30 NOVEMBER • 1600 • ROOM 320C

GLOBALLY ORIENTED AUGMENTED TRAINING AND SIMULATION

Session Chair: Ray Compton, LMI
Session Deputy: Jonathan Schlueter, CACI International

21109 Agent Based Simulation of Naval Tactics with Effectiveness Analysis Features
Erkin Çilden, Ahmet Sezer, M. Haluk Canberi, STM Defense Technologies Engineering and Trade, Inc.

21137 3D User Interfaces for Public Safety: Addressing Fidelity in Virtual Testbed Development
Katelynn Kapalo, Brown University; Jack Lewis, Christopher Johnson, Jeffrey Karhoff, Scott Ledgerwood, National Institute of Standards and Technology Public Safety Communications Research Division (NIST PSCR)

21159 Logistic Simulation to Support Military Rescue Chains
Rene Kleint, ESG Elektroniksystem und Logistik GmbH; Thomas Mayer, Tobias Uhlig, University of the Armed Forces Munich

SIM3 1 DECEMBER • 0830 • ROOM 320C

CYBERSPACE SOLUTIONS FOR MULTI-DOMAIN OPERATIONS

Session Chair: Mike Fagundes, DEVCOM Aviation and Missile Center/ USINDOPACOM J321
Session Deputy: Justin Tygart, USMC/MCSC PM Training Systems

21244 Using Cyberspace Electromagnetic Activities M&S for Multi-Domain Operations Challenges
COL Chad Bates, Ph.D., U.S. Army Cyber Command; Clark Heidelbaugh, Jim Ruth, Mark Riecken, Ph.D., Tim Friest, Trideum Corporation

21258 A Cyberspace Effects Server for LVC&G Training Systems
Omar Hasan, Ph.D., Jeffrey Welch, Robert Burch, Dignitas Technologies, LLC; J. Allen Geddes, Nathan Vey, U.S. Army DEVCOM SC STTC

SIM4 1 DECEMBER • 1400 • ROOM 320C

INTEGRATED CREATIVE TERRAIN SIMULATION

Session Chair: Tara Kilcullen, Training and Readiness Accelerator, NSTXL
Session Deputy: Aaron Hart, USAF (AFLCMC) Simulators

21123 Advanced Real-Time Radar Simulation: Maintaining Range Resolution for Large-Area Ground Maps
Radu Visina, Colton Smith, Greg Carter, David Kirk, Information Systems Laboratories

21139 Ground Material Segmentation for UAV-based Photogrammetric 3D Data: A 2D-3D Hybrid Approach
Meida Chen, Ph.D., Andrew Feng, Ph.D., Yu Hou, Ph.D., Kyle McCullough, Pratusha Bhuvana-Prasad, University of Southern California Institute for Creative Technologies; Lucio Soibelman, Ph.D., University of Southern California Department of Civil and Environmental Engineering

21366 Rapid Prototyping for Simulation and Training with the Rapid Integration & Development Environment (RIDE)
Arno Hartholt, Kyle McCullough, Ed Fast, Andrew Leeds, Sharon Mozgai, Tim Aris, Volkan Ustun, Ph.D., Andrew Gordon, University of Southern California Institute for Creative Technologies; Christopher McGroarty, DEVCOM/Soldier Center/STTC

SIM5 1 DECEMBER • 1600 • ROOM 320C

AMPLIFYING OUTCOMES BY IMPROVING EXISTING TECHNOLOGY

Session Chair: Christina Welch, Ph.D., NAWCTSD
Session Deputy: Huntley Bodden, PM TRASYS

21104 Developing a Multilingual Auto-coding Interface Control for the MAVERIC-II Dynamics Simulator
Mason Nixon, Leidos, Inc. / University of Alabama in Huntsville Department of Electrical Engineering

21155 An Augmented Reality Thunderstorm Simulation to Improve Aviation Weather Pilot Training
Kexin Wang, Eliot Winer, Ph.D., Michael Dorneich, Ph.D., Philippe Meister, Iowa State University; Lori Brown, Geoff Whitehurst, Ph.D., Western Michigan University

21206 Environment Extension: A Passive Interactivity Approach to Immersive AR/MR
Shane McConnell, Air University

SIM6 2 DECEMBER • 0830 • ROOM 320C

IMPROVING WARFIGHTER TRAINING WITH SIMULATION

Session Chair: Paul Andrzejewski, HigherEchelon
Session Deputy: Colleen Matthews, PEO STRI

21315 Improved Air-Ground Simulation Training with Future Integrated Training Environments (FITE) in XCD
Matthew Franz, William Helfinstine, Matthew LeVan, Dale Moyer, Mark Torpey, Deborah Wilbert, Lockheed Martin Corporation; Ryan Brown, MAGTF Training Command

21333 Improved Small Unit Maneuver via Pre-Operation Simulation
K. Daniel Cooksey, Ph.D., Emily Strube, Georgia Tech Research Institute; Patriel Stapleton, University of Florida

21340 Technology for an Affordable Augmented Reality Fire Support Team Trainer
Colin Sullivan, Richard Schaffer, Laura Cerritelli, Lockheed Martin Corporation; Supun Samarasekera, Kevin Kaighn, Taragay Oskiper, Ph.D., Rakesh Kumar, Ph.D., SRI International

TRAINING

TRN1 30 NOVEMBER • 1400 • ROOM 320B

ADAPTING TRAINING TO REALITY

Session Chair: Julie Kent, The MITRE Corporation
Session Deputy: Kevin Oakes, SAIC

21226 Training for Stressful Operations using Adaptive Systems: Conceptual Approaches and Applications
Tor Finseth, Michael Dorneich, Nir Keren, Warren Franke, Stephen Vardeman, Iowa State University

21280 Leveraging Legacy Training in Modern Systems: Framework and Implementation
Katherine Smith, Jessica Johnson, Virginia Modeling, Analysis & Simulation Center - Old Dominion University; Ted Dennis, TED text LLC

21308 Objective Neurological Measurement for Learning: A Review
JJ Walcutt, Ph.D., Clay Strategic Designs; Dhiraj Jeyanandarajan, QNeuro

TRN2 30 NOVEMBER • 1600 • ROOM 320B

IMPROVING AVIATION TRAINING ON THREE CONTINENTS

Session Chair: Perry McDowell, MOVES Institute
Session Deputy: Brian Vogt, CMSP, SAIC

21113 Augmenting Pilot Training Through A Non-Invasive Eye-Tracking System
Kyle Wilson, Alexander Robinson, Mike Lenné, Seeing Machines; Mark Corbett, Royal Australian Air Force - Institute of Aviation Medicine

21119 Design of a Reference Training for Simulator Specification and Syllabi Optimization for the Defence Helicopter Command
Anneke Nabben, Ronald Blankenspoor, Jelke van der Pal, NLR

21381 Improving Learning After the Accident: VR & Aviation Mishap Education
Richard Schanda, USAF

TRN3 1 DECEMBER • 0830 • ROOM 320B

AR/VR IS IT REAL...

Session Chair: Robert Wallace, 29 Training System Squadron
Session Deputy: Charles Listak, U.S. Space Command

21173 Scanning Analysis of Novice and Experienced Hoist Operators: Simulation Using a Virtual Reality Hoist Training System
Michael King, Marine Institute of Memorial University; Stephen Lenser, Barbarie Palmer, Bluedrop Training and Simulation, Inc.; Derek Rogers, Total Response Solutions; Heather Carnahan, Ph.D., Marine Institute of Memorial University

21360 Adapting a Sports Research Method to Accelerate Rapid Reaction Skills in Military and Law Enforcement
Peter Fadde, Ph.D., Southern Illinois University
Mohammadreza Jalaeian, ShadowBox Training LLC

TRN4 1 DECEMBER • 1030 • ROOM 320B

LEARNER-CENTERED TRAINING IN DEFENSE

Session Chair: Heather Oonk, Pacific Science & Engineering Group
Session Deputy: Cheryl Johnson, Ph.D., NAWCTSD

21246 Lessons Learned for Implementing Adaptive Blended Learning Experiences using Moodle
Jody Barto, Tarah Daly, Cognitive Performance Group; Amy Lafleur, USMC Training Command; Natalie Steinhauser, NAWCTSD

21222 Enhancing Military Exercise Team Performance with Diversified xAPI Instrumented eLearning
MG Serhii Salkutsan, Col Andrii Golovanov, Col Andrii Shyhyda, Lt Col Maksym Tyschenko, The National Defence University of Ukraine; Biljana Presnall, Jefferson Institute

21120 Personalisation of Learning: Developing the Case for Implementation within Defence Learning Establishments
Matt Richins, Defence Science and Technology Laboratory (Dstl), UK Ministry of Defence; Audrey Caldeira-Hankey, Carole Deighton, Ph.D., Defence Science and Technology Laboratory (Dstl), UK Ministry of Defence; Daisy Mundy, RINA Consulting Defence Ltd.; Tracy Grimshaw; Karen Newell; Adrian Snook, Learning Accelerators

TRN5 1 DECEMBER • 1600 • ROOM 320B

TRAINING ENHANCEMENT THROUGH DATA ANALYTICS

Session Chair: Liz Gehr, Ph.D., The Boeing Company

Session Deputy: Marwane Bahbaz, PEO STRI

21332 Forging Competency and Proficiency through the Synthetic Training Environment with an Experiential Learning for Readiness Strategy
Benjamin Goldberg, Ph.D.,DEVCOM - Soldier Center, Simulation and Training Technology Center; Kevin Owens, Kevin Gupton, Applied Research Laboratories: The University of Texas at Austin; Kevin Hellman, Combined Arms Center Fort Leavenworth, KS; Robby Robson, Ph.D., Eduworks; Shelly Blake-Plock, Yet Analytics, Inc.; Michael Hoffman, Dignitas Technologies

21330 Data, What Is It Good For? We Don't Know!
Matthew Littlejohn, SAIC

21238 Providing Better Feedback to Aviators through Automated Human Performance Analysis
Robert Siegfried, Torsten Müller, Aditerna; Krzysztof Rechowicz; Mark Burgess, Prevailance Aerospace

TRN6 2 DECEMBER • 0830 • ROOM 320B

SIMULATION DESIGN

Session Chair: Nir Keren, Ph.D., Iowa State University
Session Deputy: Scott Schutzmeister, Institute for Defense Analyses

21110 An Emulation of a Flying Boom Operator Using a Rule-Based Expert System
Hung Tran, Michael Tillett, Nguyen Tran, CAE USA

21350 Interplay to Facilitate Decision-Making Under Uncertain Maritime Operations
Gregory McGowin, Nathan Sonnenfeld, Atsusi Hirumi, University of Central Florida; Brandilynn Hubbard; Melanie Yarbrough; Stephen Fiore

TRN7 2 DECEMBER • 1030 • ROOM 320B

DESIGNING THE FUTURE OF TRAINING

Session Chair: Mark Parsons, SAIC
Session Deputy: Sean Osmond, CMSP, Improbable

21121 Accelerating Marine Corps Training Through Innovation
Paul Butler, Amy Lim, George Dias, Tarun Nadipalli, The MITRE Corporation; Garrett Loeffelman, TECOM (RTPD)

21165 Modular and Multimodal: Delivering Distributed and Scalable Technical Training
Catherine Thistle, NAWCAD WOLF; Jason Noren, Booz Allen Hamilton

21295 Bringing the Debrief into Three Dimensions with Augmented Reality
Kevin Hawkins, U.S. Air Force

TRN8 2 DECEMBER • 1030 • ROOM 320D

SOCIAL INTERACTIONS

Session Chair: Julie Kent, The MITRE Corporation
Session Deputy: Gernai Bledsoe, USAF AFLCMC/WNS

21171 Learner Feedback as Collaborative Problem Solving
Frederick Diedrich, Ph.D., Independent Consultant; Jayne Allen, Randy Brou, Army Research Institute; Tatiana Toumbeva, Krista Ratwani, Aptima, Inc.; Scott Flanagan; Sophia Speira; Rebecca Blood, Military Advisor Training Academy

21329 Perceptions of the Use of Synthetic Crewmembers in Aircrew Training: Instructor and Student Perspectives
Emily Anania, John Killilea, Beth Atkinson, NAWCTSD; Bill Schmermund, ASEC; Emma Burns, Zenetex

21380 Adapting Tactic Fire-Control for Indirect Fire Weapons in Live Training
Peter Tewksbury, Inertial Labs Inc.; Michael Wright, DEVCOM Armaments Center

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OPTIMIZING AR FOR MEDICAL TRAINING

Session Chair: Alexandra Steiner, Ph.D., American Systems
Session Deputy: Angela Alban, SIMETRI, Inc.

21133 Optimal Use of Immersive Technologies for Critical Decision-Making Instruction
Conner Parsey, Combat Capabilities Development Command Soldier Center SFC Paul Ray Smith Simulation and Training Technology Center; Joanne Barnieu, Engineering and Computer Simulations, William Pike, Ph.D., U.S. Army DEVCOM-SC STTC; Grace Teo, Eric Sikorski, Quantum Improvements Consulting; Nathan Ginos, Madison Quinn, Engineering and Computer Simulations

21147 Examining Technology, Human, and Contextual Factors Impacting AR Utility for Learning
Jennifer Riley, Ph.D., Kay Stanney, Ph.D., Claire Hughes, Cali Fidopiastis, Design Interactive, Inc.

21169 Usability Evaluation of Augmented Reality Training for Battlefield Care Tasks
Larry Moralez, Design Interactive, Inc.

PROFESSIONAL DEVELOPMENT WORKSHOPS

Friday, 3 December 2021 — Professional Development Workshops

LOCATION: Orange County Convention Center, South Concourse, note room assignments below.

DATE: Friday, 3 December

TIMES: 0700 Limited Continental Breakfast and Registration
0800 – 1200 All Sessions

WHO MAY ATTEND? All registrants of I/ITSEC are welcome to attend.

FEES: There is no fee for I/ITSEC Conference Registrants/Exhibitors – I/ITSEC badge required for entry.

CEU/CLP: Paid I/ITSEC Conference registrants are eligible to receive CEU/CLP credits. If not a paid attendee, a $45 fee will be charged only if you wish to receive the CEU credits.

REGISTRATION: Registration for individual workshops is not required. Workshops fill on a first-come, first-serve basis. Please arrive early for topics that interest you the most — **seating is limited**. If you wish to receive CEU credits, be sure to request CEUs during your conference registration. You may update your registration to include CEUs at any time at **http://www.iitsec.org/attend/registration-fees**

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Workshop Schedule:

0700 Limited Continental Breakfast and Registration
0800 – 1200 All Sessions

- Live-Virtual-Constructive (LVC) Interoperability Techniques
- Harnessing the Power of Data Analytics to Optimize Training
- A Process for Integration and Execution of Distributed LVC Events
- Fundamentals of Adaptive Instructional Systems (AISs) Workshop
- Deep Evolved AI for the Neural Net Enthusiast
- Evaluating the Impact and ROI of LVC Training and Education Programs and Innovations to Improve Program Effectiveness and Efficiencies
- OMG DDS 101 Professional Development Workshop
- Certified Modeling and Simulation Professional 3.0
- Design, Build, Evaluate, and Implement Conversation-based Intelligent Systems

2 • ROOM 331A

Live-Virtual-Constructive (LVC) Interoperability Techniques

Presenters: Edward Powell, Ed Powell Consulting; Randy Saunders, The Johns Hopkins University Applied Physics Laboratory (JHU/APL)

This workshop will provide an overview of the systems engineering issues with regard to integrating disparate military simulations for analysis, training, testing, and other purposes. We will discuss the three major interoperability techniques, the Distributed Interactive Simulation (DIS), the High Level Architecture (HLA) for Modeling and Simulation, and the Test and Training Enabling Architecture (TENA), including descriptions of their architectures and some of their use cases. Recent and planned evolution of each architecture will be explained. A discussion of how these architectures are actually used in the real world and the process for integrating disparate systems in a multi-architecture environment will be discussed. The format of the workshop will be part lecture and part informal discussion/question answer. Participants are encouraged to raise specific topics any time during the workshop.

4 • ROOM 331B

Harnessing the Power of Data Analytics to Optimize Training

Presenters: Liz Gehr, Ph.D., Barbara Buck, Ph.D., Laurie Dunagan, The Boeing Company

Data analytics offers a principled approach to examining data and making it a valuable resource for understanding complex interactions and improving operations. The training community has unique needs and obstacles when attempting to implement a standard data analytics approach. New technology and emerging standards such as xAPI enable the collection of data from a variety of training sources, including student records, training devices, student performance during training, and student daily activities. The collection, preparation, integration, and understanding of this wealth of data present many obstacles as well as opportunities. This workshop will provide an overview of common and emerging data analytics methods as they relate to training data, as well as how they can be applied to enable and support a learning ecosystem, including competency based learning and adaptive learning. Although this is not a class on how to use Artificial Intelligence (AI) or xAPI, we will touch on how these topics relate to data analytics. One main focus will be the challenges associated with applying standard data analytics methods in a military training environment. Other topics covered will include how to prepare, transform, and store data for

PROFESSIONAL DEVELOPMENT WORKSHOPS

analysis, opportunities in data visualization, the role of learning analytics in competency-based learning, and privacy issues.

6 • ROOM 331C

A Process for Integration and Execution of Distributed LVC Events

Presenters: Michael O'Connor, CMSP, Roy Zinser, Trideum Corporation; Kenneth LeSueur, U.S. Army Redstone Test Center

The authors have presented a tutorial on this topic for several years that covered a subset of the process. The Professional Development Workshop format will allow the authors to cover the full process and provide more examples.

Integration and execution of large distributed Live, Virtual, Constructive (LVC) events consume substantial time and resources. While the underlying distributed LVC technologies are mature, the methods for integrating events are not. The IEEE Std 1730-2010 Distributed Simulation Engineering and Execution Process (DSEEP) standard defines a process model for developing an event. DSEEP defines a set of seven steps divided into activities. The DSEEP process model provides representative inputs and outputs for each activity. However, the user still must instantiate the DSEEP process model and develop artifact templates. The development of a robust instantiation of the DSEEP process model is a substantial effort.

The goal of the DSEEP model is to produce a verified distributed LVC environment to conduct the event. While distributed LVC environments can be created without using a well-defined process, not using a one adds risks to the event. The first risk is that the integration fails, and it may be difficult to discover the reason. The second risk is that the unverified environment produces invalid results that might not be apparent until the results are used.

Based on years of distributed LVC event experience, the authors have created an instantiation of the DSEEP process model. This workshop will describe the complete nine step instantiated process and provide examples of the artifacts created by its execution. Lessons learned from executing the instantiated process and how they have been incorporated will be provided. This workshop will provide the detailed inputs, tasks, outputs, and examples for each activity in the step. The process presented includes issues related to distributed LVC environments using

8 • ROOM 331D

Fundamentals of Adaptive Instructional Systems (AISs) Workshop

Presenters: Robert Sottilare, Ph.D., Soar Technology, Inc.; Jeanine DeFalco, Ph.D., U.S. Army DEVCOM-STTC; Xiangen Hu, Ph.D., The University of Memphis

The effectiveness of artificially adaptive instructional systems (AISs) has highlighted a need in the US military for intelligently tailored and guided instruction for both individuals and teams. AISs can automatically adjust feedback, support, direction, and difficulty of instruction to address the specific needs of individual learners and teams.

This workshop provides a fundamental overview of AISs which are computer-based systems, tools and methods that guide learning experiences by tailoring instruction and recommendations based on the goals, needs (learning gaps) and preferences of each learner in the context of domain learning objectives. AISs adapt training and education to accomodate the individual differences in learners to facilitate their learning experiences, enhance their performance, and promote transfer of learning from training to operational (work) environments. AISs use AI and other advanced technologies to help people learn.

This workshop builds on and extends an I/ITSEC tutorial of the same name. The workshop will review adaptive instructional military needs (e.g., US Army Synthetic Training Environment), AIS conceptual models and design principles, adaptive instructional strategies and intelligent agent-based policies, related IEEE standards and recommended practices (Projects 2247 and 9274), and provide projections for the AIS marketplace. The workshop will also provide participants the opportunity to contexualize AIS authoring and real-time instructional mechanisms used in the Generalized Intelligent Framework for Tutoring (GIFT), an adaptive instructional architecture that has been broadly applied to cognitive, psychomotor, and collective training domains. Participants will "ride along" with the facilitators as they develop an adaptive course from scratch.

9 • ROOM 330E

Deep Evolved AI for the Neural Net Enthusiast

Presenters: Randal Allen, Ph.D., CMSP, Zachry Engel, Ph.D., Mark Volpi, Lone Star Analysis

This workshop will engage participants through a series of lectures coupled with hands-on exercises. I/ITSEC-relevant technologies will include optimization, deep neural networks, and signal classification. For each area, fundamental theory will be presented for context and the hands-on exercises will build upon one another with the threaded theme. The participant will be acquainted with emerging concepts and innovative technologies describing current state of the art. While each technology area will be covered thoroughly, a few of the topics are highlighted below:

- **Optimization** – stochastic optimization; nonlinearity, nonconvexity, and discontinuity

Note: This session presents the technology (e.g., discontinuities and constraints) which supports training neural net models, necessary for the subsequent sessions.

- **Deep Evolved AI** – correlated histogram clustering; input/hidden/output layers; nodes; activation functions; loss functions; alternative architectures and novel architectural elements; backpropagation

Note: This session orients the participant to main-stream AI methods, but also shows some architectural elements are unnecessary.

- **Signal Classification** – Raw data features; signal parameters; matched filters; signal classification

Note: This session pulls the prior session together with a signal classification application.

Each lesson will build upon the previous lesson until the participant fully develops an artificial intelligence/machine learning (AI/ML) model deployed to an environment for signal classification. At the conclusion of the Workshop, participants will have a complete understanding of a relevant application of AI to signal classification and its underlying technology, while simultaneously addressing neural net critiques by removing the opaqueness of machine learning "black boxes" so they can easily interpret the results and fully explain how the transparent system works.

12 • ROOM 330F

Evaluating the Impact and ROI of LVC Training and Education Programs and Innovations to Improve Program Effectiveness and Efficiencies

Presenter: Tim Brock, Ph.D., CPT, CRP, ID (S&L+), ROI Institute

Innovation is the lifeblood of practically every organization. Innovation drives growth, development, and strategic advantage for many organizations. This advantage includes training and education programs that use LVC simulation as a learning and performance sustainment medium. Stakeholders expect these programs to offer significant value to improve military preparedness and mission outcomes. Yet, it is now necessary to add bottom line and ROI funding justifications to support three government mandates to (1) decrease costs, (2) increase value through improved efficiencies and outcomes, and (3) expand sustainable capabilities to compensate for continuing funding decreases. This workshop introduces the ROI Methodology that applies design thinking principles to demonstrate the value of using simulation in training and education programs using terms and measures that government, military, and corporate executives understand and desire to make initial and ongoing funding decisions. It will also show how over 6,000 organizations worldwide are evaluating the impact and ROI of performance improvement programs to improve their effectiveness and competitive advantage in combat and marketplace environments.

13 • ROOM 330G

Using the ML-Agents Toolkit and the Unity 3D Game Engine to Train Intelligent Agents to Capture the Flag

Presenters: Miguel Alonso, Jr,. Joseph Mercado, Unity Technologies; Andrew Kemendo, Unity 3D

Effective use of Machine Learning (ML) within the Department of Defense (DoD) is dependent on surfacing challenging problems for defense related scenarios and developing adequate benchmarks for these tasks. However, as these grand challenges are "solved," new challenges materialize requiring the creation of new environments, which is often time-intensive and requires specialized domain knowledge. Furthermore, developing hand-crafted Intelligent Agents (IA) to operate in these environments is equally challenging, time-consuming, and often intractable, resulting in resources spent with sub-optimal results. ML enables developers to create IAs that learn their behavior from data, as opposed to hard coding behaviors based on domain specific expertise. ML is used in many domains and can be applied to military decision making in a number of interesting ways, with the most promising approach being developing software to have agency via a simulation. The two most prominent methods to teach agents are Reinforcement (RL) and Imitation Learning (IL). In RL, an agent is trained to generate a policy or set of instructions by taking in observations and performing actions. This policy is then optimized to maximize the cumulative reward that the agent receives while taking actions in an environment. IL, uses demonstrations that are recorded observation/action pairs, formally called the expert trajectory, to train the agent. IL is most useful when the reward function is difficult to define by hand or when it is simpler to show the agent what the appropriate behavior is. This workshop will focus on introducing attendees to RL, IL, and ML, using the ML-Agents toolkit and the Unity3D game engine.

15 • ROOM 330H

OMG DDS 101 Professional Development Workshop

Presenters: Robert Proctor, Jr., Dan King, John Breitenbach, Real-Time Innovations

Are you building the next generation of distributed simulation systems? Modular Open Systems Approaches (MOSA) improve system affordability by reducing integration, maintenance and upgrade costs, while promoting reuse and competition. With its interoperability, portability, loose coupling and real-time Quality of Service (QoS), the Object Management Group's Data Distribution Service (OMG DDS) standard is the preeminent foundation for distributed mission-critical MOSA systems. OMG DDS allows defense contractors to maintain an open and competitive acquisition capability and ensure that systems integrators focus their innovation efforts on program objectives.

This Professional Development Workshop will focus on the genesis of the OMG DDS Standard and the technical details of the capabilities it provides to developers who are building distributed systems. Attendees will view demonstrations of the technology to explain the behaviors and benefits of OMG DDS for real-time mission-critical OA systems. The second half of the seminar will be a hands-on session walking users through the creation of their first OMG DDS application. This will include developing an application from scratch and showing publish/subscribe of topics dynamically on a Local Area Network and with time permitting a Wide Area Network as well.

17 ROOM 330A

Certified Modeling and Simulation Professional 3.0

Presenter: Ivar Oswalt, Ph.D., CMSP, The MIL Corporation

The Certified Modeling and Simulation Profession (CMSP) certification program has been reinvented and is being reintroduced to the M&S community as CMSP 3.0 at I/ITSEC 2021. The certification's application process has been streamlined, the examination updated, and an approach to

ensure readily available reference material developed, amongst many other additional improvements.

This CMSP 3.0 Professional Development Workshop is a four-hour session that will describe the requirements needed to achieve this valuable certification. It will cover the application and examination processes including education, work experience, and reference requirements; application processes; how the exam is administered and scored; and the role of continuing education in certificate renewal. It will also provide timely insights into preparing for and achieving this certification. In addition, it will describe the examination tracks offered, discuss sample exam questions, and include several relevant simulation videos. Finally, the workshop will conclude with an enjoyable interactive game-show style exercise to summarize the material covered as well as a round-table discussion regarding ongoing efforts to ensure this certification's future success.

20 • ROOM 330B

Design, Build, Evaluate, and Implement Conversation-based Intelligent Systems

Presenters: Xiangen Hu, Ph.D., Keith Shubeck, Brent Morgan, The University of Memphis

The Institute of Electrical and Electronics Engineers (IEEE) recently approved a standard committee for Adaptive Instructional Systems (AIS, https://sagroups.ieee.org/2247-1/). This is a significant milestone for advanced personalized learning, which is recognized as one of the grand challenges of the 21st century by the National Academy of Engineering. The proposed workshop will be a support for the I/ITSEC special event on AIS (proposed by the AIS Consortium, https://aisconsortium.com/). The workshop will introduce participants to one example of a conversation-based AIS (CbAIS). Typical CbAISs hold conversations with tutees in natural language. They are successful, in part, due to their close modeling of what is considered the gold-standard of learning, individual tutoring. Participants will gain an in-depth look into the development, authoring, and implementation of AutoTutor, a CbAIS. The organizers all have experience developing multiple versions of this system, covering a wide range of domains (e.g., Critical Thinking, Physics, Reading, Electronics, and Chinese Reading & Mathematics).

Effective CbAISs are based on human learning principles. For example, a tutor agent will ask deep-level reasoning questions and tutor students with an expectation-misconception-tailored dialogue. The CbAIS helps students through a series of tutoring "moves", such as a pump, hint, prompt, assertion cycle. These are grounded in explanation-based constructivist theories, and provide sufficient scaffolding for students to acquire a deep understanding of the content.

This workshop will introduce the theory and history of constructing effective tutoring content applied within the system. Participants will gain insight into the technology that delivers this content to the learner, with a hands-on implementation of a new CbAIS lesson. Afterwards, the workshop will demonstrate how interaction data is recorded and queried in a Learning Record Store. Finally, participants will learn how to deploy their CbAIS lesson to the cloud by using common learning management systems.