



**Simulation Interoperability
Standards Organization**

"Simulation Interoperability & Reuse through Standards"



2018 Winter Simulation Innovation Workshop (SIW)

Event supported by **NTSA**

January 21-26, 2018, Florida Hotel & Conference Center at the Florida Mall, Orlando, FL



The Simulation Interoperability Standards Organization (SISO) serves the global community of modeling and simulation (M&S) professionals, providing an open forum for the collegial exchange of ideas, the examination and advancement of M&S-related practices and technologies, and the development and management of standards and other products that enable greater M&S capability, interoperability, credibility, reuse, and cost-effectiveness. As a recognized International Standards Development Organization, SISO, through its members, transforms ideas, proven practices, and innovative technologies into products that can be used and reused by M&S professionals.

SISO provides standards, guidance, and reference products on its website for downloading at no charge. Please visit <http://www.sisostds.org/> for more information.

NTSA | NATIONAL TRAINING & SIMULATION ASSOCIATION

The National Training and Simulation Association (NTSA) is America's premier organization representing the interests of the modeling and simulation community worldwide. As such, it serves as a constant point of contact for government, academia, industry, research organizations and the military to exchange information, share knowledge, align business interests and in general stimulate growth and overall advancement of the industry. NTSA pursues these goals through a series of conference, meetings and exhibitions throughout the year. NTSA produces The Interservice/Industry Training, Simulation and Education Conference (I/ITSEC), which is the world's largest conference and exhibition dedicated to modeling and simulation. While NTSA primarily serves the North American community of practice, many of its members and participants are non-US. NTSA is a key member of the International Training and Simulation Alliance (ITSA), a worldwide group of simulation associations that promotes knowledge and information about training and simulation worldwide.

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Agenda Highlights

MONDAY - 1-22

Morning Tutorials
Plenary Session
Paper Presentations by Track
SISO Social
Evening Tutorials

TUESDAY - 1-23

Newcomers' Orientation Breakfast
SIWzie Paper Forum
General Session
Paper Presentations by Track
Evening Working Sessions

WEDNESDAY - 1-24

Paper Presentations by Track
Morning Working Sessions
General Session
Paper Presentations by Track
Evening Working Sessions

THURSDAY - 1-25

Morning Working Sessions
General Session
Afternoon Working Sessions

FRIDAY - 1-26

DMSCO Special Session



SISO CONFERENCE COMMITTEE – Paul Gustavson

We are pleased to have you here in Orlando for our first ever Winter Simulation Innovation Workshop (SIW).

On behalf of the Simulation Interoperability Standards Organization (SISO) Conference Committee, I want to welcome you to SIW. Thank you for participating in what we hope you will find to be a week of

- expanding your horizons,
- contributing new ideas, and
- networking with your colleagues.

There are a number of folks that have been preparing for your arrival, and are excited that you are here! I particularly like what my colleague Jim Coolahan shared in preparation for this event when it was originally scheduled this past Fall -- before it was postponed due to Hurricane Irma.

“This is the second year of the Simulation Innovation Workshop, and might be thought of as a “toddler” finding its way in the big world of technical conferences. But as the old-timers know, SIW, identified as the Simulation Interoperability Workshop, was born in the fall of 1996 just a few miles from here. From that viewpoint, the SIW is celebrating its 21st birthday, so let’s raise a toast to its new adulthood!”

He adds, “There are many innovations in the modeling and simulation community that have seen their early applications and successes discussed at the SIW. In 1996, interoperable simulation was the innovation of its day – but we have many more innovations that have followed, and will follow”

I love Jim’s comment; it fits our theme this week, which is Simulation – Enabling Real-World Innovation, and reminds us of our opportunity to shape the future. Innovation almost always starts with the question, “I wonder if we can do that?” When you think about it, “Shouldn’t simulation be the proving ground for innovation?”

The 2018 Winter SIW is an opportunity for us to explore how we can enable innovation in the real world through simulation – and what innovations in simulations and simulation standards are still needed. To foster our discussions, we have some great sessions, papers, panels and speakers planned this week; including former NASA astronaut Dr. Story Musgrave, who will share with us on Tuesday. As a veteran of six spaceflights, he may be best remembered as the lead spacewalker for the Hubble Space Telescope repair mission in 1993. You can imagine how many simulations Story executed before that real-world mission!

As you go through this week, if you have any ideas on how to make the next SIW even better, please let us know. Look for an attendee with a Conference Committee label. Or feel free to send me an e-mail after the SIW at paulgustavson@simventions.com.

Paul Gustavson
SISO Conference Committee Chair



SISO EXECUTIVE COMMITTEE - Michael J. O'Connor

I would like to wish all of our attendees a very warm welcome to the 2018 Winter Simulation Innovation Workshop. Orlando is well known for its vast selection of dining and entertainment options and the Florida Hotel is within a short driving distance from the area's leading attractions. While we have a packed agenda for the week, I hope you will be able to find some time to enjoy Orlando while you are in town.

SISO continues to improve the Simulation Innovation Workshop to meet our members' needs. This year we have invited Dr. Story Musgrave to speak. I am looking forward to his perspective on modeling and simulation. The Conference Committee has done a great job of organizing this workshop and selecting speakers. They are continuing to evolve the format. Please let the CC members know what you think of the format.

The Standards Activity Committee has a very big job in managing all of the standards development efforts. There are a number of groups meeting this week and SISO could not develop standards without the support of our members. We often hear that it takes too long to develop standards. This is often because a small group is doing most of the work. Please get involved with these groups to add your knowledge and help improve the process.

SISO is a volunteer organization and nothing gets done without the help and support of members. I want to thank all of the volunteers that make SISO the organization it is. We need more members to volunteer for leadership positions in SISO. In the last election we had unfilled elected positions on the CC and the Planning & Review Panels (PRPs). If you are interested in serving on the CC or PRPs, please let the chairs know you are interested. Also, please consider running for the elected positions next year. I am looking for to see all of y'all in Orlando for our second Simulation Innovation Workshop.

Michael O'Connor
SISO Executive Committee Chair



STANDARDS ACTIVITY COMMITTEE – Dr. Katherine L. Morse

On behalf of the SISO Standards Activity Committee (SAC), welcome to the 2018 Winter SIW. I'm surprised at how quickly my year returning as the chair of the SAC has gone. I'm particularly grateful to the other members of the SAC including those who accepted appointments on short notice for pitching in to make this a productive and collegial year for the SAC. This year we've focused on completing a backlog of standards and reference products including the Distributed Debrief Control Architecture (DDCA), Simulation Reference Markup Language (SRML), and Coalition Battle Management Language (C-BML) standards, as well as the SRML Guide, and the Federation Engineering Agreements Template (FEAT) User's Guide and Fuel Economy Federation FEAT example.

We're also tackling new efforts like the standards roadmap that will relate our standards efforts to each other, helping new users to easily discover other standards that may be of value to them. It will also help guide our future standards development work as we identify gaps. We're continuing our efforts to make the work of our users easier, including significantly streamlining the annual PSG reports. I recognize that this doesn't sound very exciting, but I hope they will make the process just a little bit smoother for the dedicated volunteers who produce our standards, because making their job easier is really the SAC's job.

Speaking of our dedicated volunteers, the SAC thanks you for choosing to spend your precious time giving back to this professional community through your involvement in standards development. For those of you who are new to SISO, this is your opportunity to get involved in the process. Your expertise and participation will create better standards. Your organizations and customers will benefit from your participation in standards activities including additional insight and understanding of the standards, exposure to new approaches and technologies, and increased interaction with peers in the community. The SAC encourages those interested in standards development to attend the Standards 101 seminar on Monday to learn more about our processes.



CONFERENCE/WORKSHOP ACTIVITIES - Mark McCall

As always, this Workshop represents the efforts of dozens of people. Some of them wear badges with colored ribbons, showing the committees on which they serve. Others, including our support staff, work behind the scenes, producing our published documents, supporting our volunteer committees, maintaining our web site, and keeping dozens of email reflectors up to date. We ask you to talk to us, providing positive reinforcement in areas where you think things are going well, and providing suggestions for improvements in areas where we can do better. If you would like to become active on a SISO committee, Study Group, or Product Development/Support Group, introduce yourself to someone already involved in a related activity. Ask them how to get more involved.

Over the history of SISO, no individual with an idea, a willingness to work, and a reasonable level of initiative has ever failed to find a spot within our flexible structure to try to turn their idea into reality!

Finally, don't forget to have some fun this week as you meet colleagues you see only once or twice a year, make new friends, and discover other people who share your enthusiasm for a particular aspect of modeling and simulation.

Mark McCall
Executive Director

General Information

SISO WEBSITE

For information about SISO Workshops, Elections, how to subscribe/unsubscribe to the reflector and *much* more, visit our website at:

<http://www.sisostds.org>

SISO COPYRIGHT

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CONTACT INFORMATION

SISO MEMBERS, Please keep your contact information current!

Please verify/update your SISO Membership contact information at the below URL: <http://www.sisostds.org> and click on the SISO Membership globe in the top right hand side bar and select: "Log into the SISO Member Database". Don't forget to select "SUBMIT" to save any changes that you make to your information!

If you have any questions, please email Erica Weiss at eweiss@ist.ucf.edu.

REGISTRATION

The Registration Desk is located in the *Mezzanine Area* on the *2nd floor*. All registrants need to check in at the registration desk to receive an identification badge and reference materials. Name badges ***must*** be worn at all Workshop functions.

REGISTRATION HOURS

Sunday	21 January 2018	1500-1700
Monday	22 January 2018	0700-1700
Tuesday	23 January 2018	0700-1700
Wednesday	24 January 2018	0700-1700
Thursday	25 January 2018	0700-1200
Friday	26 January 2018	Not Open

EXHIBITS

Be sure to make it a part of your conference plans to visit the SISO exhibit area located in the *Salon 1* on the 2nd floor. There will be several companies on-hand to show you their new and evolving technologies. The hours the exhibits are open are listed below:

EXHIBIT HOURS

MONDAY	22 January 2018	1430-1530	1700-1900
TUESDAY	23 January 2018	0800-1015	1200-1700
WEDNESDAY	24 January 2018	0800-1015	

BREAKS

BREAKS are scheduled from 1000-1030 and 1500-1530 on Monday - Thursday.

Below is the location of the BREAK area for each day:

		Morning Break	Afternoon Break
MONDAY	22 January 2018	Mezzanine (2 nd floor)	Salon 1 (2 nd floor)
TUESDAY	23 January 2018	Salon 1 (2 nd floor)	Salon 1 (2 nd floor)
WEDNESDAY	24 January 2018	Salon 1 (2 nd floor)	Salon 1 (2 nd floor)
THURSDAY	25 January 2018	Mezzanine (2 nd floor)	Mezzanine (2 nd floor)

MESSAGE CENTER

A Message Board will be located at the registration area Monday-Thursday. All incoming phone messages/faxes will be posted to this message board.

Telephone messages:	(407) 859-1500	Request to speak with the Simulation Interoperability Workshop (SIW) registration area.
FAX messages:	(407) 855-1585	Please be sure to specify the "SIW Workshop" on the cover sheet. If you would like to send a fax, there is one available at the hotel Business Center (across from hotel registration desk).

PAPER PRESENTATIONS

To view a paper presentation that was uploaded to our site *before* the conference: See: <https://www.sisostds.org/Default.aspx?tabid=105&EntryId=45828>

HOTEL RESTAURANTS

Marcelo's Bistro	Breakfast Buffet	0700-1100
	Lunch	1100-1400
	Dinner	1700-2200 (TBD)
Cricket's Lounge	Monday-Friday	1400-2400
	Weekends	1200-2400
Starbucks		0600-2100
Grab & Go		0830-2200

HOTEL BUSINESS CENTER/INTERNET ACCESS

Complimentary wireless internet is now available in the hotel lobby and all the meeting rooms.

The Business Center is located in the lobby on the first floor and is available and open on a 24-hour basis. You will need your room key to access the business center.

Photocopies

Black and White Complimentary (limited)

Fax Machines

Domestic Fax Complimentary
International Fax \$5.00 per page

Boarding pass printing is complimentary

SISO MEMBERSHIPS

You are automatically enrolled as a SISO Member by being a registered and paid attendee of this workshop.

All **new** SISO members will receive a SISO membership number via email approximately **two** weeks following this workshop. Your membership number will allow you to download papers and documents from the SISO website, participate in SISO Elections, and participate in the development of SISO Products.

To find information on the many benefits of being a SISO Member, please visit our membership page on the SISO website:

<http://www.sisostds.org/Membership/BenefitsofMembership.aspx>

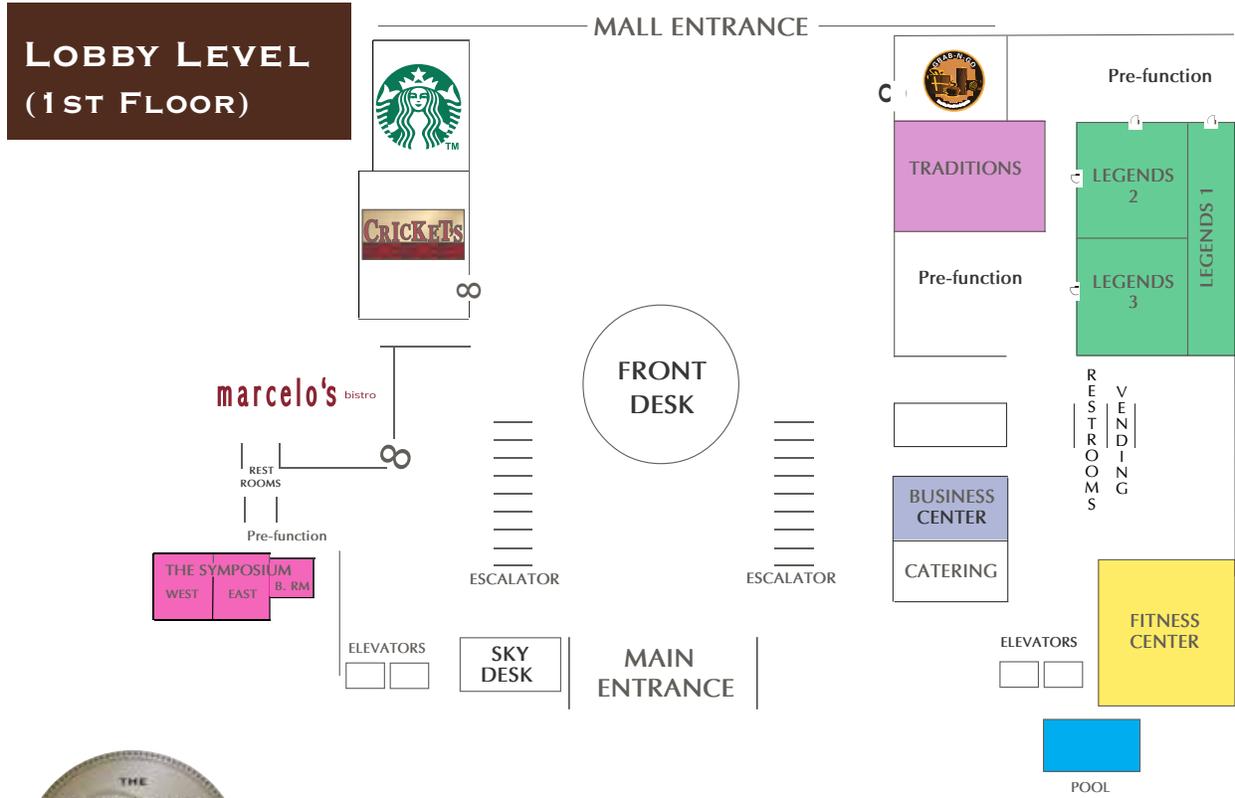
If you should have any questions concerning your membership ID number, please contact Erica Weiss at 407-882-1378 or email eweiss@ist.ucf.edu.

Future SISO Workshop Dates

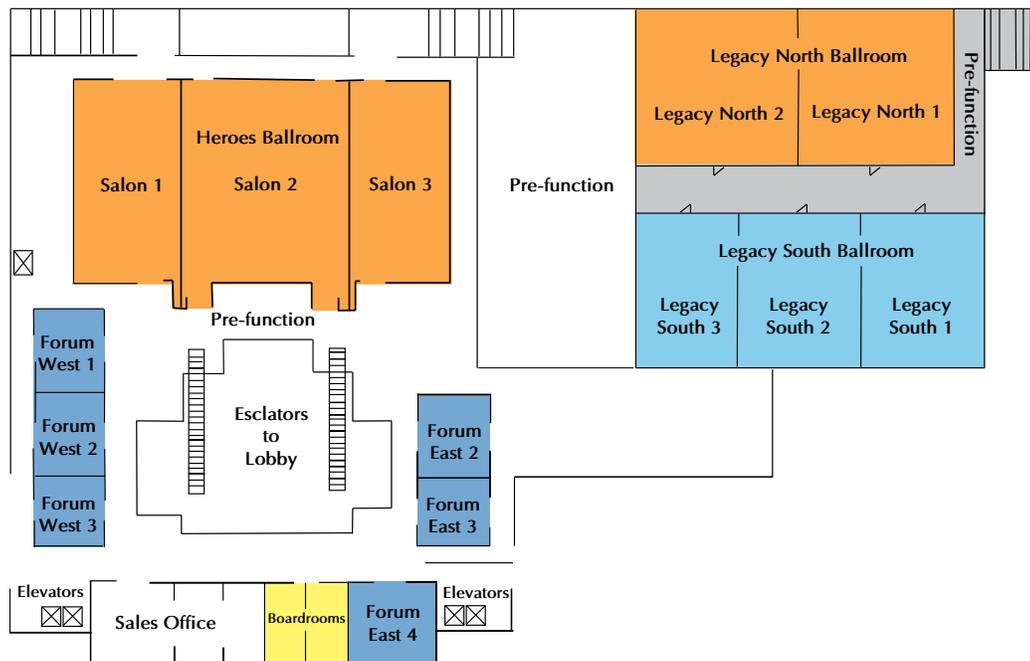
2018 Fall SIW
9-14 September 2018
Orlando, FL

Hotel Map

LOBBY LEVEL (1ST FLOOR)



MEZZANINE LEVEL (2ND FLOOR)





DR. MICHAEL R. MACEDONIA
ASSISTANT VICE PRESIDENT FOR RESEARCH AND INNOVATION
DEPUTY DIRECTOR, APPLIED RESEARCH INSTITUTE
UNIVERSITY OF CENTRAL FLORIDA

Dr. Michael R. Macedonia is the Assistant Vice President for Research and Innovation at the University of Central Florida, Deputy Director for the UCF Applied Research Institute, and Co-PI of the DIA-sponsored Intelligence Community Center for Academic Excellence (IC CAE). UCF is the largest university in the United States and the largest producer of engineering graduates for the US aerospace industry.

He is a computer scientist and an expert on simulation technologies. Prior to joining UCF, he was a Vice President and Technical Fellow at SAIC, and a General Manager for a virtual world software startup. Previously, he was a member of the Senior Executive Service and Director of the Disruptive Technology Office (now IARPA) for the Office of the Director of National Intelligence in Washington, DC. IARPA is the U.S. intelligence community's centrally funded research activity for advanced technology. Prior to DTO, he was the Chief Technology Officer for PEO STRI (formerly STRICOM) in Orlando, FL and was responsible for the technology strategy of the U.S. Army's lead simulation and training system development organization. During this time, Dr. Macedonia was the STRICOM lead in developing the Institute for Creative Technology (ICT).

Before coming to Orlando, Dr. Macedonia was Vice President for Research at the Fraunhofer Center for Research in Computer Graphics in Providence, RI, which developed breakthrough telemedicine technology for DARPA. He also served as an Army officer in infantry and intelligence positions and as a member of the Uniformed Army Scientist Corps.

He has a Ph.D. in computer science from the Naval Postgraduate School, a MS in Telecommunications from the University of Pittsburgh, and BS in Electrical Engineering from the United States Military Academy, West Point. He is a member of the IEEE Computer Society, the Association of Computing Machinery and the Army Science Board.



MR. JESSE CITIZEN
DIRECTOR
DEFENSE MODELING AND SIMULATION COORDINATION OFFICE

In August 2007, Mr. Jesse Citizen became the Director of the Modeling and Simulation Coordination Office (M&SCO), where he leverages his broad understanding of DoD missions, professional military operations, and modeling and simulation (M&S). Prior to assuming his role as the M&SCO Director, Mr. Citizen was an Air Force officer completing over 33 years of service. His last military position was Chief, Modeling and Simulation Policy Division, in the U.S. Air Force Headquarters, Washington DC, where he was responsible for developing all modeling and simulation policy for the Air Force and providing oversight for all Air Force centrally-managed M&S programs.

Originally from Beaumont, Texas, Mr. Citizen enlisted in the US Air Force in 1973, and commissioned as a Second Lieutenant in the Air Force in 1979 after graduating from Wayland Baptist University in Plainview, Texas. He has an extensive civilian and professional military education, and an operational and technical background. He completed three Masters Degrees, the Marine Command and Staff College, Air Command and Staff College, attendance at the prestigious Air War College, and recently completed course work toward a doctoral of business administration. Mr. Citizen has held a wide variety of operational positions including Air Battle Manager within the North American Air Defense system Tactical Air Control System and over 1700 hours onboard the NATO Airborne Warning and Control System (AWACS).

His international experience includes Chief of the Air Command and Control Interoperability Section at the Supreme Headquarters Allied Powers Europe (SHAPE), now Allied Command Operations, where he oversaw the development of political-military policy and operational requirements for NATO Air Command and Control System. In addition, Mr. Citizen served as the military assistant to the Air Force Chief Information Officer, readiness evaluator and military assistant to the DOD Inspector General, and Chief, Tactical Control Systems Integrations, Plans and Programs Directorate, Headquarters Air Force.

Mr. Citizen works closely with the Department's coalition partners in the areas of existing and emerging M&S science and technology. Mr. Citizen, among the past chairpersons of the NATO Modelling and Simulation Group (NMSG), continues to support the NMSG. The NMSG mission is to promote cooperation among Alliance bodies, NATO Member Nations and PfP Nations to maximize the effective utilization of M&S. From 2009 - 2015, he also served as Chair, M&S Technical Panel 2, The Technical Cooperation Program (TTCP).

This background in Defense, combined with Mr. Citizen's role as a consultant supporting M&S activities in Department's military training program, provides him a deep appreciation for the direct benefits of M&S toward achieving the Department's missions, operations, and supporting Warfighters to our global partners.



**DR. STORY MUSGRAVE
FORMER ASTRONAUT, STUDENT, ARTIST, SCIENTIST, DESIGNER, ENGINEER, MENTOR, EDUCATOR,
SPEAKER AND CONSULTANT**

Story Musgrave was born in 1935 on a dairy farm in Stockbridge, MA. He was in the forests alone at 3 and by 5 floated his homebuilt rafts on the rivers. He rode combines at 5, drove trucks and tractors at 10 and when alone in remote fields repaired them by 13.

He never finished school, ran off to Korea with the U. S. Marines where he was an aircraft electrician and engine mechanic. He started flying with the Marines and over the next 58 years accumulated 18,000 hours in over 160 aircraft. He is a parachutist with over 800 freefalls.

He has graduate degrees in math, computers, chemistry, medicine, physiology, and literature. He has been awarded 20 honorary doctorates. He was a part-time trauma surgeon for the duration of his astronaut career.

Story was a NASA astronaut for over 30 years and flew on six spaceflights. He performed the first shuttle spacewalk on Challenger's first flight, was a pilot on an astronomy mission, conducted two classified DOD missions, was the lead spacewalker on the Hubble Telescope repair mission and operated an electronic chip manufacturing satellite on Columbia. He was the communicator in mission control for 25 missions.

Today he is a producer/director of multimedia, a landscape architect, a heavy equipment operator, an innovator with Applied Minds Inc, and a professor of design at Art Center College of Design in Pasadena, CA. Story also performs multimedia corporate presentations on the topics of design driven innovation, project management, operations, human performance, reliability, quality and safety.

He has 7 beautiful children: Lorelei, Scott, Holly, Todd, Jeff, Lane and Story, ranging from age 57 to 10 years, 3 beautiful grandchildren, and a beautiful wife, Amanda.

**LT COL STEFAN UNGERTH
HEAD
SWEDISH AIR FORCE COMBAT SIMULATION CENTER**



Lieutenant Colonel Stefan Ungerth is Head of the Swedish Air Force Air Combat Simulation Center at Swedish Defence Research Agency in Kista north of Stockholm. His military duty as a warfighter fast jet pilot in the Swedish Armed Forces (Air Force) includes JAS 39 Gripen experience and work within the Operational Test and Evaluation (OT&E) unit as well as the position as quality manager in the Armed Forces headquarters procurement and training division (air force). He has a Master of Science degree in engineering from Chalmers University of Technology and is graduated from the Management program at the Swedish Defence University. Furthermore, as an Air Traffic pilot in commercial air transport business (Scandinavian Airlines System, SAS) and with the background as a teacher in performance for ATPL students, Stefan has a broad experience in the use of simulation facilities and is well suited to manage one of the prime air combat simulator facilities in Europe.

2018 SIWzie Nominated PAPERS

In preparation for each workshop or conference, the Conference Committee or Program Committee identifies the papers considered to be “the most important to be read by the people who were not able to attend the Workshop or Conference.” Three of these papers will be presented during the Best Paper Forum, Tuesday, 0830-1000, in Salon 2.

Below is the list of those papers that have been nominated to receive a 2018 Winter “SIWzie” Award. To view the individual papers, go to website: <https://www.sisostds.org/Default.aspx?tabid=105&EntryId=45828>

18W- SIW-004 **Using the Distributed Simulation Engineering and Execution Process (DSEEP) as a Guide or Research and Prototype Conceptual Modeling**

Eric Whittington, JHU/APL, USA
Jeff Bergenthal, JHU/APL, USA
Randy Saunders, JHU/APL, USA
Kirk Horton, U.S. Army/A9IW, USA

18W- SIW-007 **Simulation Independent Model Configuration**

F.P.J. van Wermeskerken, TNO, Netherlands
G.R. Ferdinandus, TNO, Netherlands
T.W. van den Berg, TNO, Netherlands
K. van den Bosch, TNO, Netherlands
R.M. Smelik, TNO, Netherlands
H. Henderson, TNO, Netherlands

18W- SIW-022 **Challenges of Developing and Deploying ISR Training to the Fleet**

Mark Thomas, Alion Science and Technology, USA
Rodney Wright, Alion Science and Technology, USA
Steven R. Moore, Alion Science and Technology, USA

18W- SIW-028 **Gen3: What's Up with DIS Version 8**

Robert Murray, SimPhonics, USA

18W- SIW-038 **Design and Principles Enabling the Space Reference FOM**

Björn Möller, Pitch Technologies, Sweden
Edwin Z. Cruz, NASA, USA
Dan Dexter, NASA, USA
Alfredo Garro, University of Calabria, Italy
Michael Madden, NASA, USA
Anton Skuratovskiy, RusBITech, Russia

AN INTRODUCTION TO SISO (SISO 101)

FORUM WEST 1

Note: There is no fee for this tutorial session

TIME: 0800-1000

INSTRUCTOR: Mark McCall, SISO Executive Director

PREREQUISITE: Interest in learning more about SISO and how to become involved in SISO activities.

This tutorial is hosted by the SISO Executive Director who explains SISO's principles, processes and organizational makeup.

AN INTRODUCTION TO THE SISO STANDARDS DEVELOPMENT PROCESS (SISO STANDARDS 101)

FORUM WEST 1

Note: There is no fee for this tutorial session

TIME: 1030-1200

INSTRUCTOR: Lance Marrou – SAC Secretary

PREREQUISITE: Interest in learning more about SISO and how to become involved in SISO activities.

This tutorial session is hosted by leaders of the SISO Standards Activity Committee who explain how to become involved in the SISO standards development and support process.

INTRODUCTION TO HIGH LEVEL ARCHITECTURE (HLA 101)

FORUM WEST 2

Note: A one-time fee of \$75.00 allows you to attend any/all tutorials that are offered at this Workshop.

TIME: 0800-1000

INSTRUCTOR: Dr. Katherine L. Morse

PREREQUISITE: A general understanding of modeling and simulation.

The High-Level Architecture (HLA) is an international standard for simulation interoperability. It originated in the defense community, but is increasingly used in other domains. This tutorial provides an introduction to HLA and these IEEE Standards that specify HLA:

- IEEE Std 1516TM - 2010, IEEE Standard for Modeling and Simulation (M&S) High Level Architecture (HLA) – Framework and Rules
- IEEE Std 1516.1TM - 2010, IEEE Standard for Modeling and Simulation (M&S) High Level Architecture (HLA) – Federate Interface Specification
- IEEE Std 1516.3TM - 2010, IEEE Standard for Modeling and Simulation (M&S) High Level Architecture (HLA) –Object Model Template (OMT) Specification

This tutorial describes the requirements for interoperability, flexibility, composability and reuse, and how HLA meets those requirements. The principles and terminology of an HLA federation are given including some real-world examples.

The tutorial will cover:

- The HLA Rules that federates and federations follow.
- The HLA Interface Specification that describes the services a simulation can use for data exchange, synchronization, and overall management.
- The HLA Object Model Template that is used for describing the data exchange between simulations.

Some practical information is given about current implementations, including commercial-off-the-shelf, government-off-the-shelf, and open source implementations. The continuous development of performance, robustness of the implementations as well as available tools is also described. Finally, some advice is given on how to get started with HLA, including the use of the related process standard:

- IEEE Std 1730TM - 2010, IEEE Recommended Practice for Distributed Simulation Engineering and Execution Process (DSEEP)

Monday Morning Tutorials

AUGMENTED REALITY DEVELOPMENT

BOARDROOM 3

Note: A one-time fee of \$75.00 allows you to attend any/all tutorials that are offered at this Workshop.

TIME: 0800-1000

INSTRUCTOR: Matthew Barrett

PREREQUISITE: A general understanding of modeling and simulation.

The tutorial provides an overview of development of commercially-available virtual, augmented, and mixed reality devices. Discussion will center on use case demonstrations and relevant integration considerations based on use cases developed at the Air Force Research Laboratory at Wright Patterson Air Force Base in Dayton, Ohio.

The tutorial will cover

- Overview of Past, Current, and Future AR and VR devices
 - Market availability and accessibility of commercial products
 - Integration of devices to specific applications
- Basics of developing with the Microsoft HoloLens using Unity 5.5 and visual studio.
 - Tools needed for development and best practices
 - Short tutorial on basic hologram creation
- Localization and its requirements including inside out tracking, outside in tracking, and depth sensing
- Spatial registration and its requirements
- Project examples include
 - AR NDE app
 - Enhance Digital's F-15 maintainer app
 - (Possible tactile manifest showcase)

SIMULATION INTEROPERABILITY 101

BOARDROOM 4

Note: A one-time fee of \$75.00 allows you to attend any/all tutorials that are offered at this Workshop.

TIME: 0800-1000

INSTRUCTORS: Stefan Sandberg, Kurt Lessmann

PREREQUISITE: A general understanding of modeling and simulation.

The aim of this tutorial is to give the participants an overview of the most common simulation interoperability standards. The tutorial explains various aspects of simulation interoperability and describes how these aspects are addressed in simulation interoperability standards like DIS, HLA, RPR-FOM and TENA. The tutorial also explains some of the technologies used and the business models associated with the different standards.

DISTRIBUTED SIMULATION ENGINEERING AND EXECUTION PROCESS (DSEEP 101)

FORUM WEST 2

Note: A one-time fee of \$75.00 allows you to attend any/all tutorials that are offered at this Workshop.

TIME: 1030-1200

INSTRUCTOR(S): Dr. Katherine L. Morse, Robert Lutz

PREREQUISITE: A general understanding of modeling and simulation.

This tutorial provides an overview of:

- IEEE Std 1730™ - 2010, IEEE Recommended Practice for Distributed Simulation Engineering and Execution Process (DSEEP)

DSEEP defines the processes and procedures that should be followed by users of distributed simulations to develop and execute their simulations.

The DSEEP generalizes the Federation Development and Execution Process (FEDEP, IEEE 1516.3) to all distributed simulation environments and architectures, no longer focusing solely on the High Level Architecture (HLA).

This tutorial provides the top level steps and supporting activities for the entire process. It also introduces and illustrates the inputs, recommended tasks, and outcomes of the activities.

There will be a brief overview of the architecture-specific annexes for HLA, Distributed Interactive Simulation (DIS), and the Test and Training Enabling Architecture (TENA).

Attendees also will be introduced to:

- IEEE Std 1730.1™ - 2013, IEEE Recommended Practice for Distributed Simulation Engineering and Execution Process Multi-Architecture Overlay (DMAO)
- SISO-STD-012-2013, Standard for Federation Engineering Agreements Template

DMAO is the IEEE standard that extends the DSEEP to multi-architecture environments.

BRIDGES AND GATEWAYS

BOARDROOM 3

Note: A one-time fee of \$75.00 allows you to attend any/all tutorials that are offered at this Workshop.

TIME: 1030-1200

INSTRUCTORS: Michael O'Connor, Kurt Lessmann

PREREQUISITE: A general understanding of modeling and simulation.

Bridges and Gateways are critical to most distributed Live, Virtual, Constructive simulation environments. The role of bridges and gateways is often misunderstood by distributed simulation planners. This tutorial provides an overview of the role of gateways in distributed simulation. A description of how gateways work is also presented. The tutorial covers the process for to select a gateway that meets the needs of the distributed simulation event. The best practices for using a gateway are also covered. This tutorial will provide the attendees with a better understanding of gateways and how to use them in a distributed LVC event.

Monday Morning Tutorials

DISTRIBUTED INTERACTIVE SIMULATION (DIS 101)

FORUM WEST 3

Note: A one-time fee of \$75.00 allows you to attend any/all tutorials that are offered at this Workshop.

TIME: 1030-1200

INSTRUCTOR: Mark McCall

PREREQUISITE: A general understanding of modeling and simulation. Minimum technical background needed. Familiarity with distributed real-time simulation of vehicles and weapon system platforms is helpful.

This tutorial provides an overview of:

- IEEE Std 1278.1TM - 2012, IEEE Standard for Distributed Interactive Simulation - Application Protocols.

The tutorial includes introductory background material describing what Distributed Interactive Simulation (DIS) is; explains why DIS is a viable standard for distributed simulation; and provides information for joining an active developers group. New features added in the 2012 version, including Directed Energy Weapons, Information Operations, and the general extensibility of Protocol Data Units (PDUs) will be discussed.

HIGH LEVEL ARCHITECTURE EVOLVED FOM MODULES (HLA 202)

BOARDROOM 4

Note: A one-time payment fee of \$75.00 allows you to attend any/all tutorials that are offered at this Workshop.

TIME: 1030-1200

INSTRUCTOR: Björn Möller

PREREQUISITES: General knowledge about the purpose and principles of HLA corresponding to HLA 101. Some experience with HLA object model development is useful, but not required.

This tutorial provides an overview of how to apply:

- IEEE Std 1516.3TM - 2010, IEEE Standard for Modeling and Simulation (M&S) High Level Architecture (HLA) –Object Model Template (OMT) Specification
- Additional features for FOM development, provided in the upcoming version of HLA, informally called “HLA 4”.

The Federation Object Model (FOM) specifies the data that is exchanged between federates in an HLA federation. This tutorial shows the principles of good FOM design. It describes how FOMs can be developed maintained and reused using the Modular FOM concept, introduced in HLA Evolved (IEEE 1516-2010).

Special attention is given to the modular version of the SISO Real-time Platform Reference Federation Object Model (RPR FOM) 2.0. Other FOMs covered are the NATO Education and Training Network FOM and the upcoming SISO Space Reference FOM.

Finally, it presents new features for developing FOMs that are proposed for the next version of HLA, in particular for extending reference FOMs.

Monday Plenary Session Salon 2

1330-1500

Call to Order

Paul Gustavson, SISO Conference Committee Chair

State of SISO

Michael O'Connor, SISO Executive Committee Chair

Featured Speaker

Dr. Michael R. Macedonia, Assistant Vice President for Research and Innovation, Deputy Director, Applied Research Institute, University of Central Florida

Sponsor Speaker

Mr. Jesse Citizen, Director, Defense Modeling and Simulation Coordination Office (DMSCO)

Admin Announcements

Mark McCall, SISO Executive Director

Monday Afternoon Session and Paper Presentations

VIRTUAL WORLDS – IT’S NOT JUST FOR GAMING

SALON 2

1530-1700

Paul Gustavson, SISO Conference Committee Vice Chair

Chris Stapleton, Creative Director for Experience Design Innovation,
Simiosys Real World Laboratories

Dr. Nancy Cummings, Consultant in Higher Education and Healthcare / Principal Member of the
Virtual World Society

The invention of Virtual Reality (VR) is taking off and is capturing the imagination of the public and the media. People, however, are only now becoming aware of its history or even existence.

Many are surprised to realize these facts:

- VR has been in development for over 70 years with a variety of methods beyond goggles.
- Billions of dollars have been invested in just the past few years.
- There are millions of current users and the size is growing rapidly.
- VR is a convergence of vast types of enabling technology
- Content libraries are growing as fast as the amount of users
- It is estimated that markets will exceed over \$100 billion dollars by the year 2020

Come hear more about the future vision for VR and its impact at this special session facilitated by our good friends at the Virtual World Society (VWS). VWS, which was founded by Tom Furness, the grandfather of VR, is a global network of pioneers, developers, and organizations committed to advancing the power of virtual worlds for the good of society. Discussion topics at our SIW session include the emerging transformational tools and future standards needed to create applications that help solve real challenges beyond just gaming. Discover not just what VR can do, but the good it can do in seeking solutions to so many problems in the world. How its application in Virtual Worlds using Modeling and Simulation and the right standards can transform lives in education, training, medical procedures, health rehabilitation, digital engineering, manufacturing, as well as the arts, culture, and entertainment.

SERVICES, PROCESSES, TOOLS AND DATA (SVCS) TRACK

SALON 3

The Services, Processes, Tools, and Data (SVCS) Track encompasses Technologies, frameworks, and methodologies that provide service or support for M&S in areas of: distributed simulation process; verification, validation, and accreditation; communication infrastructure; and simulation and environment reuse.

1600-1630	18W- SIW-048 – Lessons Learned from Implementing a Common Image Generator Interface (CIGI) V4.0 COTS Based Image Generator (IG) for Driver Training	Roland Humphries
1630-1700	18W- SIW-035 – A New Paradigm for Environmental Data Generation and Management	Daniel Maxwell, PhD
1700	Wrap-Up & Adjourn	Randy Saunders

SISO SOCIAL MONDAY EVENING

1700-1900

SALON 1

Please join us for this informal gathering! Food and drink will be available. Renew acquaintances, plan your week, and meet members of the Executive Committee, Standards Activity Committee, Conference Committee, and Planning & Review Panels along with our authors/presenters at the conference. Also, take a look around at the products and technology on display in the exhibitor booths.

FEDERATION ENGINEERING AGREEMENTS TEMPLATE (FEAT 101)

FORUM WEST 1

Note: A one-time fee of \$75.00 allows you to attend any/all tutorials that are offered at this Workshop.

TIME: 1900-2100

INSTRUCTOR: Dr. Katherine L. Morse

PREREQUISITE: A general understanding of distributed simulation. An understanding of the Distributed Simulation Engineering and Execution Process (DSEEP) is beneficial.

The FEAT [SISO-STD-012-2013] is an eXtensible Markup Language (XML) schema that provides a standardized format for recording federation agreements to increase their usability and reuse.

The FEAT is designed to:

- Ensure federation and federate engineers accurately record all necessary agreements by providing a complete list of all potential agreements
- Ensure agreements are recorded in a standardized, unambiguous manner
- Enable federation participants to locate agreements rapidly or determine that a required agreement has not been recorded
- Enforce internal consistency between related agreements
- Enable the development of a new generation of federation engineering tools driven by the XML schema that reduce the cost, schedule, and risk of developing federations.

This tutorial leverages the FEAT User's Guide and Fuel Economy Federation FEAT example to illustrate the use of FEAT for a simple federation.

The tutorial will cover:

- FEAT structure including categories of agreements
- Design patterns and reuse of existing schemas
- Supporting tools and documents
- Examples of applying FEAT to the Fuel Economy Federation

REDISCOVER THE DEFENSE M&S CATALOG

FORUM WEST 2

Note: A one-time fee of \$75.00 allows you to attend any/all tutorials that are offered at this Workshop.

TIME: 1900-2100

INSTRUCTOR(S): Hart Rutherford & Rachael Orzechowski

PREREQUISITE: None

M&S industry leaders are capitalizing on the new and improved Defense M&S Catalog. This tutorial presents the new approach to search, discover, and publish M&S assets. It focuses on the purpose of the Defense M&S Catalog and how its new concept of operations simultaneously serves the local needs of M&S practitioners and the policy objectives of the United States Department of Defense.

Live demonstrations will illustrate how to effectively access and utilize the catalog's upgraded search methods, operate its menu-driven tool for creating valid metadata records, and publish locally-developed metadata records directly to the catalog without data transformation or human intervention.

The tutorial is intended for M&S Leaders, especially those in Systems Engineering, Acquisition, and Program Management, who rely on M&S to develop new system capabilities; as well as developers, project managers, and other senior technical leaders, who are responsible for the management and sharing of M&S assets.

NEW EXTENSIBILITY AND DEAD RECKONING FEATURES IN DIS VERSION 7 (DIS 201)

FORUM WEST 3

Note: A one-time fee of \$75.00 allows you to attend any/all tutorials that are offered at this Workshop.

TIME: 1900-2100

INSTRUCTOR: Robert Murray

PREREQUISITE: Familiarity with basic DIS PDU usage. Knowledge of dead reckoning is helpful, but the tutorial will include an introduction to the concepts.

This tutorial provides an in-depth review of two features: PDU extensibility and improvements in dead reckoning.

PDU extensibility expands the ability of DIS users to add custom data to PDUs. Some PDUs allow user-defined records to be directly added. Other PDUs can be extended using the new Attribute PDU. Both methods retain compatibility with older versions of DIS. This allows customized PDUs to be added in new or upgraded simulations while maintaining interoperability to older simulations that cannot be modified.

Dead reckoning has been enhanced in DIS Version 7, mainly in the extrapolation of entity orientation. A new geometric method of determining the orientation threshold is described using either quaternions or rotation matrices. This method avoids the problems of Euler angle singularities that can cause excessively high PDU transmit rates. Other new features speed up dead reckoning calculations in receiving simulations by adding extra information in the Entity State PDU. These new features maintain full backward and forward compatibility with DIS Version 5 and 6.

GAME ENGINES 101

BOARDROOM 3

Note: A one-time fee of \$75.00 allows you to attend any/all tutorials that are offered at this Workshop

TIME: 1900-2100

INSTRUCTOR: Tim Rodabaugh

PREREQUISITE: A general understanding of modeling and simulation.

The tutorial includes introductory background material describing the use of video game engines, such as Unity and Unreal, in the development of simulation capabilities for training use cases. Basic game engine mechanics will be covered, and the two foremost game engines will be compared. The tutorial will highlight data access and sharing options, including the data handling native to the engines as well as the use of the Distributed Interactive Simulation (DIS), which enable performance and physiological data and assessment within the simulations. Strategies allowing the integration of external devices and data streams will be explored. Examples will be used to highlight game engine capabilities, data handling, and integration strategies.

The tutorial will cover:

- Game engine basics including: assets creation & manipulation, physics, scripting, visuals, performance, and plugins
- Game engine evaluation
- Data extraction (control input, world information, DIS)
- Device integration (Strategies, data interleaving)
- Project examples include:
 - Eye tracker Unity 3D integration and data collection
 - Data collection using Unreal Engine
 - Data stream integration with Unity 3D
 - Virtual environment built in Unreal Engine
 - Multiplayer game-based training simulation using Unity 3D
 - DIS game integration

AGILE M&S: MAXIMIZING THE EFFICIENCY OF YOUR M&S PROJECTS

BOARDROOM 4

Note: A one-time fee of \$75.00 allows you to attend any/all tutorials that are offered at this Workshop.

TIME: 1900-2100

INSTRUCTOR: Paul Gustavson

PREREQUISITE: A general understanding of modeling and simulation.

Agile isn't just for software development, it's also well suited to support your needs as it relates to M&S. Discover how Agile can be used to support the three different bands of M&S: (1) Simulation Development, (2) Simulation Environment Development and Execution, and (3) Standards Development. The principles of Agile will help you move forward and be even more focused and relevant in supporting the needs of your users and in fostering innovation.

NEWCOMERS' ORIENTATION BREAKFAST

FORUM EAST 4

0715-0800

The Newcomers' Orientation is designed for those who have not previously participated in a Simulation Innovation Workshop (SIW). The session's goal is to help new participants gain maximum benefit from SIW and from their participation in the Simulation Interoperability Standards Organization (SISO). In this session, the SISO Leadership welcome the newcomers and answer questions relating to SISO's organization, principles, processes and SIW.

PAPER PRESENTATIONS

BEST PAPER FORUM

SALON 2

0830-0900

18W- SIW-004 - Using the Distributed Simulation Engineering and Execution Process (DSEEP) as a Guide or Research and Prototype Conceptual Modeling

Eric Whittington, JHU/APL, USA

Jeff Bergenthal, JHU/APL, USA

Randy Saunders, JHU/APL, USA

Kirk Horton, U.S. Army/A9IW, USA

0900-0930

18W- SIW-038 - Design and Principles Enabling the Space Reference FOM

Björn Möller, Pitch Technologies, Sweden

Edwin Z. Cruz, NASA, USA

Dan Dexter, NASA, USA

Alfredo Garro, University of Calabria, Italy

Michael Madden, NASA, USA

Anton Skuratovskiy, RusBITech, Russia

0930-1000

18W- SIW-028 - Gen3: What's Up with DIS Version 8

Robert Murray, SimPhonics, USA

TUESDAY WORKING SESSIONS

SPACE FEDERATION OBJECT MODEL PDG

BOARDROOM 4

The Space Reference FOM shall support interoperability for space simulations. This includes federations executing in real-time as well as federations executing in logical-time (including as- fast-as-possible). The primary focus is on training, analysis, mission support and engineering although other types of usage, like test and concept exploration may also be supported to some degree.

The PDG meeting will provide an overview and status of the first complete version of the SISO Space Reference FOM. The PDG will also discuss planning for review, test and verification of the first version.

Everyone interested in Space simulation is welcome!

0730-0830
1330-1500
1530-1700

Chair, Björn Möller

GUIDELINE ON SCENARIO DEVELOPMENT PDG

FORUM WEST 3

The Guideline on Scenario Development (GSD) Product Development Group (PDG) will be developing a SISO Guidance Product, “Guideline on Scenario Development for Simulation Environments.” The product to be developed by the PDG builds upon the work done by MSG-086 and transforms the “Guideline on Scenario Development for (Distributed) Simulation Environments” into a published SISO Guidance Product.

The PDG recently completed their first ballot and the purpose of this meeting is to resolve comments from the ballot.

1330-1500
1530-1700

Chair, Stefan Vrieler

ENUMERATIONS SPECIAL WORKING GROUP

FORUM WEST 1

The SAC Special Working Group Reference for Enumerations for Simulation publishes, maintains, and updates SISO-REF-010: Enumerations for Simulation Interoperability. SISO-REF-010 is an important resource for the entire simulation community, and we welcome all SISO members interested in enumerations usage for any standard or guidance products.

1900-2100

Chair, Lance Marrou

TUESDAY GENERAL SESSION SALON 2

1030 Call to Order **Paul Gustavson**, SISO Conference Committee Chair

1035 - 1050 Award Presentations **Mark McCall**, SISO Executive Director

1050 - 1200 Keynote Speaker **Dr Story Musgrave**
Former Astronaut, Student, Artist, Scientist, Designer,
Engineer, Mentor, Educator, Speaker and Consultant

Attendees will have the opportunity to meet Dr. Musgrave after the general session, and purchase one of his books. **Cash or Check** required.

TUESDAY PAPER PRESENTATIONS

SYSTEM LIFECYCLE AND TECHNOLOGIES (SLT) TRACK

SALON 2

The System Lifecycle and Technologies (SLT) Track encompasses information that provides guidance on the selection and use of M&S standards and practices to support the System Lifecycle and corresponding technologies that address analysis, research and development, test and evaluation, training, acquisition, asset management, and system lifecycle strategies.

1330-1400	18W- SIW-040 – Improving Tactical Data Link Simulation Standards to Better Support LVC Exercises	Jouni Lindqvist
1400-1430	18W- SIW-045 – Automating Human Factor Considerations for Acquisition Decision Making	O. Thomas Holland, PhD
1430-1500	18W- SIW-027 – Execute Smarter and Manage Risk – Apply Proven Standards	Kenneth (Crash) Konwin
1500-1530	Break	
1530-1600	18W- SIW-034 – Future Improvements to Combat Aircraft Simulation Training: MTDS As Means for More Realism	Sönke Pink, PhD
1600-1630	18W- SIW-023 – Using Game Engines to Build Virtual Training Environments	Jane Bachman
1630-1700	18W- SIW-026 – Low Cost Approaches to Combat Helo Simulations and Training	Frederick C. Webber
1700	Wrap-up & Adourn	Scott Johnston

M&S SPECIALTY TOPICS (SPEC) TRACK

LEGACY NORTH 2

The M&S Specialty Topics (SPEC) Track is concerned with simulation technologies applied for a specific purpose such as augmented reality, medical, cyber security, space, human behavior, system/vehicle or weapon product development, Internet of Things (IoT), LVC interoperability, and command and control systems.

1330-1400	18W- SIW-022 – Challenges of Developing and Deploying ISR Training to the Fleet <i>2018 Winter 'SIWzie' Awarded Paper</i>	Mark Thomas
1400-1430	Break	
1430-1500	18W-SIW-012 – Survey of Cyber Security Framework Across Industries	Ambrose Kam
1500-1530	Break	
1530-1600	18W- SIW-021 – Universal CPS Environment for Federation (UCEF)	Martin Burns
1600-1630	18W- SIW-013 – Modeling Cyber Security	Ambrose Kam
1630-1700	18W- SIW-051 – Invited Presentation: Cyber Warfare for Training Research (CyWAR-T)	Henry Marshall
1700	Wrap-up & Adourn	Sara Meyer

TUESDAY PAPER PRESENTATIONS

SERVICES, PROCESSES, TOOLS AND DATA (SVCS) TRACK

SALON 3

The Services, Processes, Tools, and Data (SVCS) Track encompasses Technologies, frameworks, and methodologies that provide service or support for M&S in areas of: distributed simulation process; verification, validation, and accreditation; communication infrastructure; and simulation and environment reuse.

1330-1400	18W- SIW-033 – Enabling the Future of Simulation w/ Data Center Technologies & Hybrid Cloud	Chuck Louisell, PhD
1400-1430	18W- SIW-032 - Balancing Technology with Cybersecurity for Modeling and Simulation in the Cloud	Matthew Rodriguez
1430-1500	18W- SIW-006 – Container Orchestration Environments for M&S	Tom van den Berg
1500-1530	Break	
1530-1600	18W- SIW-016 – Extending the Defense Modeling and Simulation Reference Architecture through Patterns	Katherine L. Morse, PhD
1600-1630	18W- SIW-043 – Invited Presentation: Latest Advancements in EMBR: A GOTS M&S Management Tool for Collaboration and Reuse	Rachael Orzechowski
1630-1700	18W- SIW-024 - Statistical Techniques for Modeling and Simulation Validation	Kelly McGinnity Avery, PhD
1700	Wrap-up & Adjourn	Randy Saunders

WEDNESDAY PAPER PRESENTATIONS

SYSTEM LIFECYCLE AND TECHNOLOGIES (SLT) TRACK

SALON 2

The System Lifecycle and Technologies (SLT) Track encompasses information that provides guidance on the selection and use of M&S standards and practices to support the System Lifecycle and corresponding technologies that address analysis, research and development, test and evaluation, training, acquisition, asset management, and system lifecycle strategies.

0830-0900	18W- SIW-003 – Predicting Pilot Proficiency with Interoperable Human Performance Assessment	Peter Neubauer
0900-0930	18W- SIW-009 – Multi National and Joint Forces Live, Virtual and Constructive Demonstration	Rachel Vickhouse
0930-1000	18W- SIW-047 – An Ontology-driven Framework for Enabling Adaptive Training Application Integration	Perakath Benjamin, PhD
1000-1030	Break	
1030-1100	18W-SIW-054 – Invited Presentation The Future of Standards in Ever-changing Simulation Environments	Tim Cooley, PhD

M&S SPECIALTY TOPICS (SPEC) TRACK

LEGACY NORTH 2

The M&S Specialty Topics (SPEC) Track is concerned with simulation technologies applied for a specific purpose such as augmented reality, medical, cyber security, space, human behavior, system/vehicle or weapon product development, Internet of Things (IoT), LVC interoperability, and command and control systems.

0830-0900	18W- SIW-050 – Augmented Reality Tool for Depot-Level Visualization, Logging, and Tracking	Timothy Rodabaugh
0900-0930	18W- SIW-019 – Creating a Tactical Pilot’s Assistant for Combat Operations in Contested Denied Environments: An Overview of Three Approaches	Winston Bennett, Jr, PhD
0930-1000	18W- SIW-008 – Configurable Adversary Response Prediction: Building Efficient Expectation Models from High-Fidelity Behavior Simulations	Randolph Jones
1000-1030	Break	
1030-1100	18W- SIW-015 – Toward a Tactical Pilot’s Assistant: A Framework for Integrating Models of Intelligent Behavior	Walter Warwick
1100-1130	18W- SIW-011 – Tactical Pilot Assistant and Denied Environments: Incorporating Socio-Technical Factors in Simulations	Benjamin Bell, Ph.D.
1130-1200	18W- SIW-053 – Invited Presentation The National Environmental Simulation and Testing Facility (NEST)	Robert C. Huck, Ph.D.
1200	Adjourn	Sara Meyer

WEDNESDAY PAPER PRESENTATIONS

SERVICES, PROCESSES, TOOLS AND DATA (SVCS) TRACK

SALON 3

The Services, Processes, Tools, and Data (SVCS) Track encompasses technologies, frameworks, and methodologies that provide service or support for M&S in areas of: distributed simulation process; verification, validation, and accreditation; communication infrastructure; and simulation and environment reuse.

0830-0900	18W- SIW-018 – Modelling and Simulation as a Service: Rapid Deployment of Interoperable and Credible Simulation Environments – An Overview of NATO MSG-136	Tom van den Berg
0900-0930	18W- SIW-007 – Simulation Independent Model Configuration <i>2018 Winter 'SIWzie' Awarded Paper</i>	Tom van den Berg
0930-1000	18W- SIW-052 – Supplemental Electromagnetic Data in DIS and its Associated Performance	Cord Cardinal
1000-1030	Break	
1030-1100	18W- SIW-030 – Cloud-Based Modeling and Simulation	COL Robert Kewley, PhD
1100-1130	18W- SIW-031 – A New Army Modeling Framework	Charles Sanders, PhD
1130-1200	18W- SIW-002 – French Improvement of Simulation Interoperability By Using Abstraction Layer Approach	Josè Ruiz
1200	Adjourn for Lunch and General Session	Randy Saunders

WEDNESDAY WORKING SESSIONS

COMMON IMAGE GENERATOR INTERFACE (CIGI) PSG

FORUM WEST 1

0730-1000

Chair, Simon Skinner

The PSG provides support for this SISO Standards Product:

- SISO-STD-013-2014, Standard for Common Image Generator Interface (CIGI), Version 4.0.

HIGH LEVEL ARCHITECTURE (HLA) PDG

FORUM WEST 2

0730-1000

Chair, Randy Saunders

1030-1200

High Level Architecture (HLA) PDG - On 5 February 2016, the IEEE Standards Association Standards Board approved three Project Authorization Requests for the revision of these IEEE 1516™ Standards:

- IEEE Std 1516™-2010, IEEE Standard for Modeling and Simulation High Level Architecture — Framework and Rules
- IEEE Std 1516.1™-2010, IEEE Standard for Modeling and Simulation High Level Architecture — Federate Interface Specification
- IEEE Std 1516.2™-2010, IEEE Standard for Modeling and Simulation High Level Architecture — Object Model Template Specification

REUSE AND INTEROPERATION OF ENVIRONMENTAL DATA & PROCESSES (RIEDP) PDG

FORUM WEST 3

0830-1000

Chair, Jean-Louis Gougeat

1030-1200

The PDG is developing products to harmonize environmental data representations and generation processes at a level after the source data stage, but before the run-time/proprietary stage, recognizing that there is a broad range within this band. This will be achieved by retaining the data form (or format) as close to the source data as possible in order to benefit from GIS tools; while at the same time keeping the internal data consistency (intrinsic correlation factor); and not introducing specific target application constraints at this level that should be addressed separately by each target application during run-time.

VERIFICATION, VALIDATION & ACCREDITATION/ ACCEPTANCE PRODUCTS (VV&A PRODUCTS) PSG

BOARDROOM 3

0830-1000

Chair, Simone Youngblood

1030-1200

1530-1730

The PSG supports these products:

- IEEE Std 1516.4™-2007, IEEE Recommended Practice for VV&A of a Federation — An Overlay to the High Level Architecture Federation Development and Execution Process
- SISO-GUIDE-001.1-2012, Guide for Generic Methodology for Verification and Validation (GM-VV) to Support Acceptance of Models, Simulations, and Data, GM-VV Volume 1: Introduction and Overview
- SISO-GUIDE-001.2-2013, Guide for Generic Methodology for Verification and Validation (GM-VV) to Support Acceptance of Models, Simulations, and Data, GM-VV Volume 2: Implementation Guide
- SISO-REF-2013, Reference for Generic Methodology for Verification and Validation (GM-VV) to Support Acceptance of Models, Simulations, and Data, GM-VV Vol. 3: Reference Manual

EPLRS/SADL PDG

FORUM WEST 1

1030-1200

Chair, Joe Sorroche

The PDG is developing a standard that defines the methods to simulate an EPLRS/SADL Network within a Distributed Interactive Simulation (DIS) or High Level Architecture (HLA) framework.

LINK 11 A/B Network Simulation Standard PDG

FORUM WEST 1

1030-1200

The PDG is developing a standard for existing military simulations to exchange Link-11 A / B data using a single interoperable standard.

This will be a shared session with the EPLRS/SADL PDG.

SPACE FEDERATION Object Model PDG

BOARDROOM 4

1330-1500

Chair, Björn Möller

1530-1700

The PDG is developing (1) a natural language, human readable overview, description and specification of the Space Reference FOM Federation Agreement; and (2) a set of computer-interpretable HLA 2010 FOM modules (XML) intended for consumption by HLA run-time infrastructure and other software tools.

WEDNESDAY GENERAL SESSION SALON 2

1330-1500

Call to Order

Paul Gustavson, SISO Conference Committee Chair

Featured Speaker

Lt Col Stefan Ungerth, Head, Swedish Air Force Combat Simulation Center

Panel Discussion

Innovation Next: Future Use M&S

Moderator – **Stefan Sandberg**, President,
Pitch Technologies

Dr. Michael Macedonia, Asst. VP for Research and
Innovation, UCF

Dr. Nancy Cummings, Consultant in Higher Education
and Healthcare, Principal Member of the Virtual World
Society

Dr. Katherine L. Morse, JHU/APL, Chair, SISO
Standards Activity Committee

Kurt Lessman, Chief Technical Officer, Trideum

WEDNESDAY PAPER PRESENTATIONS

SERVICES, PROCESSES, TOOLS AND DATA (SVCS) TRACK

SALON 3

The Services, Processes, Tools, and Data (SVCS) Track encompasses technologies, frameworks, and methodologies that provide service or support for M&S in areas of: distributed simulation process; verification, validation, and accreditation; communication infrastructure; and simulation and environment reuse.

1530-1600	18W- SIW-029 – Dead Reckoning in Geodetic Coordinates for Improved LVC Interoperability	Robert Murray
1600-1630	18W- SIW-037 – Towards a Standardized Federate Protocol for HLA 4	Björn Möller
1630-1700	18W- SIW-005 – Making Fixed Grid DDM HLA 4 Compliant: The Benefits of a Fixed Grid DDM Implementation and A Way Forward in HLA 4	Felix Rodriguez
1700	Adjourn	Randy Saunders

WEDNESDAY WORKING SESSIONS

TACTICAL DIGITAL INFORMATION LINK - TECHNICAL ADVICE AND LEXICON FOR ENABLING SIMULATION (TADIL TALES) PSG

FORUM WEST 1

1530-1700

Chair, Joe Sorroche

The PSG supports this SISO Standards Product:

- **SISO-STD-002-2006, Standard for Link 16 Simulations**

INTEROPERABILITY BETWEEN WEB-BASED FEDERATES AND LVC FEDERATIONS (WebLVC) SG

FORUM WEST 2

1530-1700

Chair, Len Granowetter

This PDG is developing a standard for a WebLVC protocol. The WebLVC protocol defines a standard way of passing simulation data between a web-based client application and a WebLVC server, which can participate in a federation on behalf of one or more web-based federates. WebLVC messages are encoded as JSON (JavaScript Object Notation) objects, passed via WebSockets. WebLVC is flexible enough to support representation of arbitrary types of objects and interactions (i.e. arbitrary Object Models). However, WebLVC does include a “Standard Object Model” definition based on the semantics of the DIS protocol, HLA’s RPR FOM, and SISO Enumerations.

HUMAN PERFORMANCE MARKUP LANGUAGE (HPML) PDG

FORUM WEST 3

1530-1700

Chair, Courtney Dean

The PDG is developing a SISO Standards Product for Human Performance Modeling Language. HPML is an XML schema-based language intended to cover all meaningful aspects of human performance measurement in various training and operational environments. The PDG is also developing the supplementary SISO Product Data Files.

Layered Simulation Architecture Discussion

Legacy North 2

1600-1700

Facilitator, Katherine Morse

SISO sponsored the Layered Simulation Architecture Study Group from 2012 to 2015. Although the final report, SI-SO-REF-057-2015, recommended moving to a product development group, there was not enough interest for the SAC to make a recommendation to the EXCOM. This meeting will discuss proposals to revive and continue the LSA work.

CLLOUD-BASED M&S DEMONSTRATION

SALON 2

1530-1700

Lead, COL Robert Kewley

The Cloud-Based Modeling and Simulation Study Group is chartered to identify and document the existing M&S in the cloud activities, document best practices, highlight lessons learned and identify where potential standards in order to facilitate adoption by other practitioners. The study group is organized into 3 different teams looking at cloud capabilities, models, and architecture.

The Study Group will provide a demonstration of Cloud-Based Modeling and Simulation and discuss some of their findings.

THURSDAY WORKING SESSIONS

A STANDARDS PROFILE FOR M&S ACTIVITIES IN SUPPORT OF ACQUISITION ACTIVITIES (ACQM&S) PDG

0730-1000 - **FORUM EAST 4**
1530-1700 - **FORUM WEST 2**

Chair, Kenneth (Crash) Konwin

Starting 9 Dec 2015, the PDG initiated a 270-day trial use period for two draft products. Users were asked to use the products and to share comments and suggestions about the products. To contribute, visit the PDG webpage, scroll to the bottom, and use the Comment Tracking System to provide inputs on these two draft SISO Products:

- SISO-GUIDE-005-DRAFT, Trial Use Guide for A Standards Profile for the Use of M&S in Support of Acquisition Activities, Volume 1
- SISO-REF-066-DRAFT, Trial Use Reference for A Standards Profile for the Use of M&S in Support of Acquisition Activities, Volume 2

HIGH LEVEL ARCHITECTURE (HLA) PDG

LEGACY NORTH 2

0730-1000 Chair, Randy Saunders
1030-1200

High Level Architecture (HLA) PDG - On 5 February 2016, the IEEE Standards Association Standards Board approved three Project Authorization Requests for the revision of these IEEE 1516TM Standards:

- IEEE Std 1516™-2010, IEEE Standard for Modeling and Simulation High Level Architecture — Framework and Rules
- IEEE Std 1516.1™-2010, IEEE Standard for Modeling and Simulation High Level Architecture — Federate Interface Specification
- IEEE Std 1516.2™-2010, IEEE Standard for Modeling and Simulation High Level Architecture — Object Model Template Specification

DISTRIBUTED INTERACTIVE SIMULATION / REAL TIME PLATFORM REFERENCE FOM (DIS/RPR FOM) PSG

FORUM WEST 1

0800-1130	Chair, Mark McCall	DIS Discussions (with break)
1130-1200	RPR FOM Report	
1530-1900	DIS Discussions (with dinner break)	

Distributed Interactive Simulation (DIS) / Real Time Platform Reference FOM (RPR FOM) PSG - in 2012, the DIS PDG published:

- IEEE Std 1278.1™-2012, IEEE Standard for Distributed Interactive Simulation - Application Protocols (a revision of IEEE Std 1278.1™-1995 and IEEE Std 1278.1a™-1998)

In 2015, the RPR FOM 2 PDG published:

- SISO-STD-001-2015, Standard for Guidance, Rationale, and Interoperability Models (GRIM) for the Real-time Platform Reference Federation Object Model (RPR FOM) Version 2.0
- SISO-STD-001.1-2015, Standard for Real-time Platform Reference Federation Object Model (RPR FOM) Version 2.0

On 14 Dec 2015, the EXCOM approved the formation of a new PSG from the DIS PSG that would incorporate responsibilities both DIS and RPR FOM products.

Working groups of the PSG meet regularly by teleconference for technical discussions and the PSG meets by teleconference to conduct business as needed.

The primary purpose of this meeting is to continue activities toward the development of Gen3 of the DIS Standard (Version 8) by reviewing the current status and approving such PCRs or concepts that are ready for PSG approval. The RPR FOM group will report on the status of their discussions on the next version of the RPR FOM.

THURSDAY WORKING SESSIONS

EXPLORATION OF NEXT GENERATION TECHNOLOGY APPLICATIONS TO MODELING AND SIMULATION **SALON 3**

0830-1000
1030-1200

Lead, Chris McGroarty

This group is executing these group-specific tasks:

- Capture and decompose common M&S program goals including accounting for non-functional requirements such as security, performance, risk, cost, and long-term sustainability.
- Explore the latest industry technology trends and available solutions, specifically focused on their applicability to the M&S domain. Examples include wearable technology, streaming, advanced hardware, cloud services, and data sharing applications.
- Account for security requirements and what the application each technology will need to consider.
- Consider other architecture quality requirements and management requirements such as risk, cost, and long-term sustainability, among others.
- Assist the M&S domain in staying informed of recent technology advancements and to understand their impacts to our current and future implementations.

COMMAND AND CONTROL SYSTEMS – SIMULATION SYSTEMS INTEROPERATION PDG/PSG **FORUM WEST 2**

0830-1000
1030-1200

Co-Chair, J. Mark Pullen

The Command and Control Systems - Simulation Systems Interoperation (C2SIM) PDG and Product Support Group (PSG) together form one lifecycle product group empowered over the product lifecycle to develop and support products. The functions of the PDG and PSG are distinct, but memberships are common, and administrative reporting will be as one group to consolidate administrative overhead. In addition to new products under development, the PSG supports these two SISO Standards Products:

- SISO-STD-007-2008, Standard for Military Scenario Definition Language
- SISO-STD-011-2014, Standard for Coalition Battle Management Language (C-BML) Phase 1

DISTRIBUTED SIMULATION ENGINEERING AND EXECUTION PROCESS (DSEEP) / DISTRIBUTED SIMULATION ENGINEERING AND EXECUTION PROCESS MULTI-ARCHITECTURE OVERLAY (DMAO) PSG **FORUM WEST 3**

0830-1000

Chair, Robert Lutz

The PSG supports these SISO-sponsored IEEE Standards:

- IEEE Std 1730™-2010, IEEE Recommended Practice for Distributed Simulation Engineering and Execution Process (DSEEP) (Revision of IEEE Std 1516.3™-2003)
- IEEE Std 1730.1™-2013, IEEE Recommended Practice for Distributed Simulation Engineering and Execution Process Multi-Architecture Overlay (DMAO)

VERIFICATION, VALIDATION & ACCREDITATION/ ACCEPTANCE PRODUCTS (VV&A PRODUCTS) PSG

BOARDROOM 3

0830-1000

Chair, Simone Youngblood

The PSG supports these products:

- IEEE Std 1516.4™-2007, IEEE Recommended Practice for VV&A of a Federation — An Overlay to the High Level Architecture Federation Development and Execution Process
- SISO-GUIDE-001.1-2012, Guide for Generic Methodology for Verification and Validation (GM-VV) to Support Acceptance of Models, Simulations, and Data, GM-VV Volume 1: Introduction and Overview
- SISO-GUIDE-001.2-2013, Guide for Generic Methodology for Verification and Validation (GM-VV) to Support Acceptance of Models, Simulations, and Data, GM-VV Volume 2: Implementation Guide
- SISO-REF-2013, Reference for Generic Methodology for Verification and Validation (GM-VV) to Support Acceptance of Models, Simulations, and Data, GM-VV Vol. 3: Reference Manual

CLOUD-BASED MODELING & SIMULATION (CBMS) SG

SALON 1

1030-1200

Lead, COL Robert Kewley

Over the past few years, a significant number of SISO members have been engaged in M&S activities in the cloud. These and other early practitioners have produced practices and hard-learned lessons that would be valuable to others. The purpose of this study group is to identify and document the existing M&S in the cloud activities, document best practices, highlight lessons learned and identify where potential standards in order to facilitate adoption by other practitioners. The study group is organized into 3 different teams looking at cloud capabilities, models, and architecture. Specific study group tasks include:

- Catalog, describe, and analyze current efforts using M&S in the cloud, identifying the advantages and disadvantages of each approach.
- Conduct a literature review of SISO papers and other literature on M&S in the cloud.
- Provide emerging guidance, resources and support to emerging practitioners.
- Investigate the potential for standards to support cloud-based M&S.
- Demonstrate cloud-based M&S capabilities.

FEDERATION ENGINEERING AGREEMENTS TEMPLATE (FEAT) PSG

FORUM WEST 3

1030-1200

Chair, Katherine L. Morse

The Federation Engineering Agreements Template (FEAT) benefits all developers, managers, and users of distributed simulations by providing an unambiguous format for recording agreements about the design and use of the distributed simulation. The FEAT also benefits this community by enabling the development of federation engineering tools that can read the XML schema and perform federation engineering tasks automatically.

The FEAT Product Support Group (PSG) supports the FEAT schema and associated reference products such as examples of application of the schema. The FEAT PSG supports the distributed simulation community by acting as a forum and library for FEAT-related information; providing technical support to users and developers by answering questions; and providing contact information for experts in different areas.

1030-1200

Chair, Robert Lutz

The PDG conducted product ballots in 2015 for these products:

- SISO-STD-014-00-DRAFT, Standard for Gateway Description Language
- SISO-STD-014-01-DRAFT, Standard for Gateway Filtering Language

The product ballots were both valid and successful. The PDG is in the process of resolving comments with the balloters and documenting final comment resolutions. At this meeting, the PDG will complete implementation of the resolutions. The next step is the preparation and processing of the Product Approval Package. Watch for new SISO Standards to be published in 2018. The family of products is used by both developers and users of Live, Virtual, and Constructive (LVC) environments during gateway selection and configuration. Each product reflects a different aspect of the overarching process of gateway selection and configuration.

THURSDAY GENERAL SESSION SALON 2

1330	Call to Order	Paul Gustavson SISO Conference Committee Chair
1335-1400	Featured Speaker	Edwin Crues , L. B. Johnson Space Center, NASA
1400-1500	Panel Discussion	Innovation Next: Interoperability Moderator - Randy Saunders Johns Hopkins University Applied Physics Laboratory Robert Lutz Johns Hopkins University Applied Physics Laboratory Steve Swenson , Aegis Technologies Lt Col Stefan Ungerth Head, Swedish Air Force Combat Simulation Center

THURSDAY AFTERNOON WORKING SESSION

CYBER M&S STUDY GROUP

FORUM WEST 3

1530-1700

Chair: TBD

The last several years have seen a significant increase in the number and variety of cyber M&S research and development efforts across government, industry, and academia. These efforts have resulted in methodologies and technologies for cyber testing and training that are functionally relevant, but largely independent. Broad and deliberate collaboration across these efforts is necessary to meet the rigorous and evolving cyber test and training demands of the defense community. The purpose of this study group is to identify key cyber M&S activities, document best practices, highlight lessons learned, and identify areas for potential standardization in order to facilitate adoption by the cyber M&S community.

0900-1500

Coordinator, Gabe Diaz, DMSCO

Overview:

The U.S. DoD's Defense Modeling and Simulation Coordination Office, the NATO Modelling and Simulation Group, and the Simulation Interoperability Standards Organization are hosting a joint working group on M&S architectures and commercial gaming technology in conjunction with the 2017 SIW. The group will focus on identifying best practices for leveraging commercial gaming technologies for Defense M&S in a modular architecture and for integration with LVC capabilities. Invitations have been extended to a mix of attendees from the services, academia and industry.

Objectives:

- Hear from industry and government how commercial gaming technologies are enabling defense training, experimentation, and acquisition.
- Hear from government the benefits and risks of adopting commercial gaming technologies, and best practices for integrating commercial products.
- Share the challenges and best practices and lessons learned for acquisition, integration, and tailoring of internationally owned or proprietary software and technology.

Who Should Attend:

- Defense program managers, simulation engineers, and LVC/Gaming stakeholders
- Industry chief technology officers, commercial gaming engineers and project managers

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Strategic Organizational Member

The Department of Defense (DoD) Modeling and Simulation Coordination Office (DMSCO) is the focal point for coordinating all matters regarding modeling and simulation across the DoD for the Undersecretary of Defense (Acquisition, Technology and Logistics) (USD(AT&L)). Modeling and simulation (M&S) is an enabler of warfighting capabilities. It helps to save lives, to save taxpayer dollars, and to improve operational readiness. DMSCO assists the DoD to use M&S in a cost-effective manner through tools, policies, standards, guidance, and collaborative forums.

The use of simulations and simulators to provide training procedures improves individual and collective capabilities. Military forces train with a wide range of simulated weapons, ships, aircraft, and other vehicles in conjunction with live training on actual equipment. Within the military, and in other professions, M&S helps provide a safer and lower resource-intensive rehearsal capability for a wide variety of training.

Training is one of the most employed of the M&S applications, but there are many other ways that M&S enables Department's functions. In particular, M&S is used to analyze and inform the Department decisions in acquiring new capabilities, adopting new tactics, processing intelligence, and testing systems before they are put into the hands of our fighting forces.

Established in 2006, with a heritage back to 1991, DMSCO fosters M&S interoperability and reuse to improve value and mission effectiveness for the Department's M&S Enterprise. The Department's M&S Enterprise consists of the military services (the Army, Marines, Navy, and Air Force); the Joint Staff; and seven communities (Acquisition, Analysis, Intelligence, Experimentation, Planning, Test/Evaluation, and Training). All parts of the whole help ensure DoD's readiness to provide for national security. The M&S Enterprise also includes other US Government agencies and international military partners. As a pivotal organization, DMSCO recommends policies, plans, and programs to the USD(AT&L) that supports the M&S Strategic Vision and DoD priorities. DMSCO can be viewed as having three distinct arenas: Operations, Governance and Technology.

Operations: DMSCO manages the sustainment and operation of enterprise level M&S capabilities - tools, data, and services - in support of USD(AT&L). DMSCO also serves as the Department's lead for M&S standards and is the point of contact for International M&S activities.

Governance: DMSCO develops strategic policy, guidance, standards, and practices, with the advice and assistance of the M&S Steering Committee (M&S SC). DMSCO also provides the Secretariat (administrative) functions for the M&S SC. As a result, the policies and standards help educate the Department's workforce, promote interoperability and reuse, and enable the DoD M&S Enterprise.

Technology: DMSCO provides technical expertise to the USD(AT&L) and provides technical coordination to M&S Enterprise and the M&S SC on DoD M&S architectures, software, computing, data, and other related enabling technologies.

A SPECIAL THANKS TO OUR SPONSORS!



NATO Modelling and Simulation Group (NMSG) is part of the NATO Science and Technology Organization (STO). The mission of the NMSG is to promote co-operation among Alliance bodies, NATO member nations and partner nations to maximise the effective utilisation of M&S.

The NMSG has been designated by the North Atlantic Council (NAC) to supervise the implementation of the NATO Modelling and Simulation Master Plan (NMSMP) and also to propose regular updates to the NMSMP. The NMSG is the delegated tasking authority on M&S interoperability standards within NATO. The NMSG M&S Standards Subgroup (MS3), consisting of NATO and national M&S experts, created and maintains the M&S Standards Profile document (published under the NATO reference AMSP-01). The second release, AMSP-01(B), was promulgated in Jan 2012 and includes more than 40 M&S related standards. The identified standards/products were included in AMSP-01 following a formal selection and classification process by the MS3 experts and is therefore considered as relevant for the NATO M&S domain. The standards and products included in AMSP-01 are formally mandated by NATO when supported by a specific STANAG. The NMSG and SISO have signed a formal technical cooperation agreement in 2007 which underpins the importance of M&S standards to the NMSG. For more information visit us at www.sto.nato.int

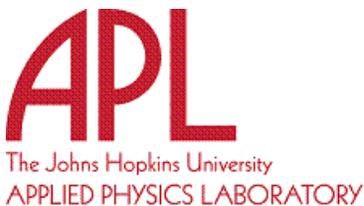


Supporting Organizational Member

AEGIS Technologies creates innovative solutions to challenges requiring specialized modeling and simulation knowledge; expertise in simulation and software development, integration, and analysis; training simulator development; HLA/DIS technologies; C4I-to-Simulation interoperability; object-oriented analysis/design; and VV&A programs for software/simulations. AEGIS provides specialized Photonics/MEMS, electro-optic, infrared/LADAR services/products. Commercial software offerings include HLA LabWorks[®] dramatically reduces HLA simulation/ federation development costs, acsIXtreme[®] provides outstanding capabilities to model real world systems using continuous simulation, and BattleStorm[®] provides a low-cost, flexible simulation framework on which multiple simulators are built. AEGIS has offices in Huntsville, Orlando, Albuquerque, Rhode Island, Washington D.C., Canada and Europe. Visit their web site at <http://www.aegistg.com>.



Aptima's mission is to engineer tools and systems that increase human capabilities. Our scientists study how humans think and learn in today's technology-rich networked environments, and we use that knowledge to solve problems and provide solutions in defense, homeland security, healthcare, aviation and cyber security. Aptima's solutions span the human continuum from the micro to the macro – from the neural and individual level, to teams and large groups, and even to complete societies. To learn more, visit <http://www.aptima.com>.



Supporting Organizational Member

A not-for-profit division of The Johns Hopkins University, the Applied Physics Laboratory (APL) is a research and development organization dedicated to solving critical problems of national security. APL's 4,500+ employees work on over 400 programs serving the U.S. Navy, U.S. Air Force, U.S. Army, the Office of the Secretary of Defense, the National Aeronautics and Space Administration, and numerous other government agencies. As a University Affiliated Research Center, APL often serves as a liaison between government and industry. Key areas of research for scientists and engineers at APL include sensors, information processing, command and control systems, navigation, guidance, propulsion, aerodynamics, oceanography, space physics, sonar, software development, signal processing, materials, biomedicine, and modeling and simulation (M&S). In M&S, APL is a leader in simulation interoperability standards and techniques, and in verification, validation, and accreditation (VV&A). For more information on APL, see the APL web site at <http://www.jhuapl.edu>.

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Supporting Organizational Member

CAE is a global leader in the provision of simulation and control technologies and training solutions for aerospace, defense and marine markets. CAE employs more than 6,000 people around the world and generates revenues in excess of C\$1 billion. CAE offers HLA compliant simulation development, control, and visualization tools under the STRIVE(tm) product line; a simulation-based eLearning/ADL (seLearning) development and deployment environment under the Simfinity(tm) product line; plus modeling & simulation training, support and professional services. Visit their web site at <http://www.cae.com>.



MÄK Technologies develops software to link, simulate and visualize the virtual world. We create tools and toolkits for distributed simulations, develop PC-based military tactical trainers, craft custom solutions, and research and develop the latest simulation technologies. We build commercial off the shelf simulation tools that are flexible, portable and supported. Whether you choose our best-selling networking toolkit VR-Link or the high performance MÄK RTI, you have purchased a product backed by the industry's leading distributed simulation experts. Please visit <http://www.mak.com> for more information.



Pitch Technologies is a leading provider of innovative state-of-the-art interoperability products, services and solutions for development of distributed systems. Our products and solutions are being used by some of the largest and most complex simulation programs in government and industry around the world.

Our experts provide the management, guidance and technical support you need to successfully integrate distributed simulation systems into an interoperable solution that meets your needs and reduces cost, risk and time-to-market.

Pitch Technologies expanding product family consists of infrastructure products, development tools and runtime tools allowing the design, integration and execution of the most complex LVC environments and supports the latest IEEE 1516 HLA Evolved standard. Pitch products have been designed to meet our customer's highest demands in terms of performance, robustness and ease-of-use.

Pitch Technologies also offers a complete range of HLA training courses targeted at general management, technical executives, project managers, developers and system integrators.

Visit www.pitch.se for more information.



Supporting Organizational Member

Presagis is a global leader providing commercial-off-the-shelf (COTS) modeling, simulation and embedded graphics solutions to the aerospace and defense markets and is the only developer to deliver a unified COTS software portfolio based on open-standards. Presagis combines cutting-edge

technology with innovative services to help customers streamline workflow, reduce project risks, create detailed models and complex simulations, in addition to developing DO-178B certifiable applications. The company services more than 1,000 active customers worldwide, including many of the world's most respected organizations such as Boeing, Lockheed Martin, Airbus, BAE Systems and CAE. For more information, visit www.presagis.com.



Supporting Organizational Member

SimPhonics is a leader in high fidelity simulation audio and networked radio systems. Well ahead of it's time, V+, a fifth generation visual programming system, forms the heart of SimPhonics software products providing extensible standards based solutions. From FAA Level D audio simulation to

realistic radio modeling for DIS/HLA, SimPhonics is committed to evolving technology in order to bring unmatched quality to our customers around the world. For nearly two decades, SimPhonics has fielded thousands of systems and has made significant contributions to establishing standards to improve interoperability. Visit <http://www.simphonics.com> for COTS pricing and technical data.

A SPECIAL THANKS TO OUR SPONSORS!



SimVentions is a privately held business, incorporated in the state of Virginia in 2000. Our corporate headquarters is located in Fredericksburg, Virginia with an additional office in Orlando, Florida. At SimVentions, expressing what we do is quite simple: We Create Component Solutions. This is true whether it be for modeling and simulations, software engineering, or systems engineering. A few of

our key solutions include Base Object Models (BOMs) within the modeling and simulation (M&S) arena, tactical software components consistent with the DoD Open Architecture Computing Environment (OACE) efforts, object-oriented components for software applications, interactive courseware modules for training, and program management and process tools in support of the rapid insertion of technology and components to warfighters. Specific to M&S, SimVentions' expertise lies in the development and use of DIS, HLA and other distributed technologies such as web services, service oriented architectures (SOA), and, within the tactical community, Object Management Group's (OMG) Data Distribution Service (DDS). SimVentions has been an integral part in the research, standardization and development of various processes and concepts including Base Object Models (BOMs), Simulation Reference Markup Language (SRML), HLA Evolved, Federation Development and Execution Process (FEDEP), Coalition Battle Management Language (C-BML), Military Scenario Definition Language (MSDL), use and application of Metadata within the M&S community, and all with an eye for supporting composability and reuse within the greater SISO and M&S community. Additional experience includes the development of a suite of tools to facilitate the development of HLA federations and analysis of DIS simulations. SimVentions also has significant experience and background supporting various DoD related activities including the surface Navy in Dahlgren, VA and Washington D.C., and the U.S. Marine Corps in Quantico, VA.



Supporting Organizational Member

Thales is a global technology leader for the Defence & Security and the Aerospace & Transport markets. In 2010, the company generated revenues of €13.1 billion with 68,000 employees in 50 countries.

With its 22,500 engineers and researchers, Thales has a unique capability to design, develop and deploy equipment, systems and services that meet the most complex security requirements. Thales has an exceptional international footprint, with operations around the world working with customers as local partners.

Thales recognizes the importance of modelling and simulation in support of the systems engineering lifecycle, from concept development and experimentation through to testing and evaluation. Thales is also a world-leader in providing simulation-based training systems. SISO is considered an important forum within which to share advanced methods and technologies and to draw upon complementary capabilities to meet the specific requirements of our customers.



Trideum Corporation is a privately owned and operated small business, founded in 2005, headquartered in Huntsville, Alabama. Trideum specializes in providing solutions and services in the area of Modeling & Simulation (M&S), Test & Evaluation (T&E), Capabilities Analysis and Management, and

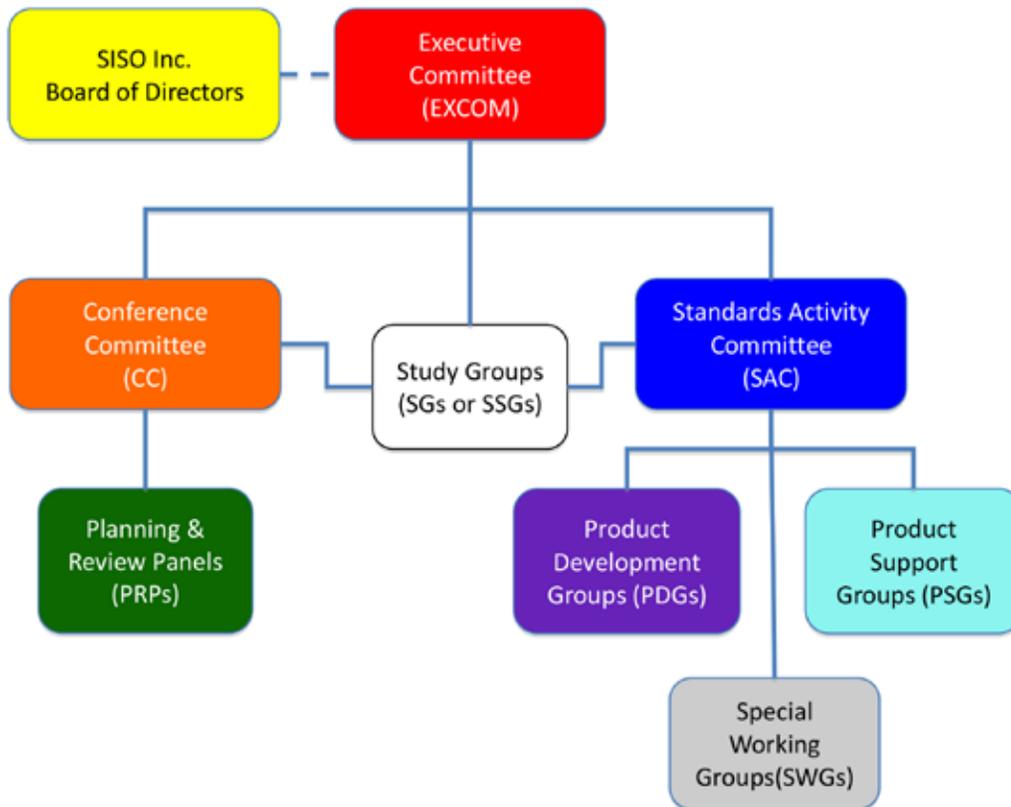
Training/Training Development.

In addition to our Huntsville headquarters, Trideum operates a Program Office in Leavenworth, Kansas, as well as Field Offices in the Northern and Tidewater regions of Virginia; Orlando, Florida; Washington; Arizona; Ohio; and Texas.

Trideum has a broad range of expertise gained through hands-on program execution. Our offering ranges from strategic to operational, technical, and analytical requirements planning to engineering analysis, design, development and integration. We are involved in the development, design, building and operation of synthetic environments for testing, training and experimentation.

Our Quality Management System (QMS) is certified in accordance with ISO 9001:2008. Trideum was named to INC5000 in 2015, as one of America's fastest growing companies.

SISO Organization



SISO INC. – BOARD OF DIRECTORS (BOD) - 2017-2018

The Board of Directors (BOD) is responsible for financial oversight of SISO and for SISO’s contractual relationships with other organizations.

Lutz, Robert
 Graham, David
 Morse, Katherine
 Sandberg, Stefan
 O’Connor, Michael
 McCall, Mark (non-voting)

Chairman
President
Vice President
Secretary
Treasurer
Assistant Treasurer

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 markmccall@sisostds.org

SISO Executive Director

McCall, Mark
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markmccall@sisostds.org

2017–2018 Leadership

SISO EXECUTIVE COMMITTEE (EXCOM) MEMBERS - 2017

The Executive Committee (EXCOM) is the policy body that provides overall governance and strategic planning to SISO.

O'Connor, Michael (2019)	Chair	moconnor@trideum.com
Lutz, Robert (2018+)	Vice Chair	robert.lutz@jhuapl.edu
Abbott, Jeff (2019+)	Secretary	jefferybabbott@hotmail.com
Daly, John (2017)		daly_john@bah.com
Diem, John (2017+)		john.w.diem.civ@mail.mil
McGlynn, Lana (A)		lana.mcglynn@gmail.com
Scrudder, Roy (2019)		scrudder@arlut.utexas.edu
Siegfried, Robert (2018+)		robert.siegfried@aditerna.de
Whittington, Eric (2018)		eric.whittington@jhuapl.edu
Morse, Katherine L. (X)	SAC Chair	katherine.morse@jhuapl.edu
Coolahan, Jim (X)	CC Chair	jim.coolahan@comcast.net

NEWLY ELECTED - SISO EXECUTIVE COMMITTEE (EXCOM) MEMBERS - 2018

O'Connor, Michael (2019)	Chair	moconnor@trideum.com
Lutz, Robert (2018+)	Vice Chair	robert.lutz@jhuapl.edu
Abbott, Jeff (2019+)	Secretary	jefferybabbott@hotmail.com
Konwin, Kenneth (2020+)		konwin_kenneth@bah.com
McGlynn, Lana (2020+)		lana.mcglynn@gmail.com
Oates, William (A)		william.oates@us.af.mil
Sandberg, Stefan (2020+)		stefan.sandberg@pitch.se
Scrudder, Roy (2019)		scrudder@arlut.utexas.edu
Siegfried, Robert (2018+)		robert.siegfried@aditerna.de
Whittington, Eric (2018)		eric.whittington@jhuapl.edu
Morse, Katherine L. (X)	SAC Chair	katherine.morse@jhuapl.edu
Gustavson, Paul (X)	CC Chair	pgustavson@simventions.com
<i>Liaisons:</i>		
Heaphy, Michael	DMSCO	michael.heaphy@dla.mil
Huiskamp, Wim	NATO MSG	wim.huiskamp@tno.nl

SISO CONFERENCE COMMITTEE (CC) MEMBERS - 2017

The Conference Committee (CC) organizes the Simulation Interoperability Workshops and oversees several Conference Forums in which information and new ideas are exchanged within and across various components of the M&S Community.

The Conference Committee (CC) organizes the Simulation Innovation Workshops and oversees several tracks in which information and new ideas are exchanged within and across various components of the M&S Community.

Coolahan, Jim (2019)	Chair	jim.coolahan@comcast.net
Gustavson, Paul (2018)	Vice Chair	pgustavson@simventions.com
Bachman, Jane (2018+)	Secretary	jane.bachman@navy.mil
Allen, Gary (2017)		gallen6@outlook.com
Graham, David (2018+)		david.graham@cae.com
Hambleton, Orris (2017+)		profh@comcast.net
Riggs, Bill (A)		riggswc1@jhuapl.edu
Ruiz, Jose (2018+)		jose.ruiz@intradef.gouv.fr
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Stoudenmire, Eugene (2017)		astoudenmire@earthlink.net
Winner, Jennifer (2018+)		jennifer.winner.1@us.af.mil
Igarza, Jean-Louis (X)	SAC Vice Chair	JeanLouis.Igarza@icloud.com

NEWLY ELECTED - SISO CONFERENCE COMMITTEE (CC) MEMBERS - 2018

Gustavson, Paul (2018)	Chair	pgustavson@simventions.com
<i>Vacancy (2018)</i>	Vice Chair	
Bachman, Jane (2018+)	Secretary	jane.bachman@navy.mil
Coolahan, Jim (2019)		jim.coolahan@comcast.net
Daly, John (2019+)		daly_john@bah.com
Drake, David (2019+)		david.drake@jhuapl.edu
Graham, David (2018+)		david.graham@cae.com
Lessmann, Kurt (2019+)		klessmann@trideum.com
Riggs, Bill (A)		riggswc1@jhuapl.edu
Ruiz, José (2018+)		jose.ruiz@intradef.gouv.fr
Winner, Jennifer (2018+)		jennifer.winner.1@us.af.mil
<i>Vacancy (2019)</i>		
Igarza, Jean-Louis (X)	SAC Vice Chair	JeanLouis.Igarza@icloud.com

SISO STANDARDS ACTIVITY COMMITTEE (SAC) MEMBERS - 2017

The Standards Activity Committee (SAC) provides oversight for all standards activities, including the Balloted Products Development and Support Process, and oversees the groups that are studying, developing, and supporting SISO products. SAC is also a Sponsor Committee of the IEEE Computer Society Standards Activities Board and is responsible for the IEEE Standards developed by SISO groups and for ensuring compliance with IEEE processes.

Morse, Katherine L. (A)	Chair	katherine.morse@jhuapl.edu
Igarza, Jean-Louis (2018)	Vice Chair	JeanLouis.Igarza@icloud.com
Marrou, Lance (2017+)	Secretary	lance.r.marrou@leidos.com
Dillman, Brad (2018+)		braddillman@gmail.com
Gupton, Kevin (A)		kgupton@arlut.utexas.edu
Kreiner, Aerial (2018+)		aerial.kreiner@us.af.mil
Le Leydour, Patrice (2018+)		patrice.leleydour@thalesgroup.com
McGroarty, Chris (2017+)		christopher.j.mcgroarty.civ@mail.mil
Mclean, Thom (Angus) (2018)		thom@gatech.edu
Oates, William (2017)		william.oates@afams.af.mil
Stevens, John (2017+)		john.stevens@coleengineering.com
Youngblood, Simone (2017)		simone.youngblood@jhuapl.edu
Gustavson, Paul (X)	CC Vice Chair	pgustavson@simventions.com
<u>Liaisons:</u>		
Bailey, Grant	NATO MSG	grant.bailey.127@mod.gov.uk

NEWLY ELECTED SISO STANDARDS ACTIVITY COMMITTEE (SAC) MEMBERS - 2018

Morse, Katherine L. (2019+)	Chair	katherine.morse@jhuapl.edu
Igarza, Jean-Louis (2018)	Vice Chair	JeanLouis.Igarza@icloud.com
Marrou, Lance (2019)	Secretary	lance.r.marrou@leidos.com
Bailey, Grant (2019+)		grant.bailey.127@mod.gov.uk
Dillman, Brad (2018+)		braddillman@gmail.com
Gupton, Kevin (A)		kgupton@arlut.utexas.edu
Heaphy, Michael (A)		michael.heaphy@dla.mil
Kreiner, Aerial (2018+)		aerial.kreiner@us.af.mil
Le Leydour, Patrice (2018+)		patrice.leleydour@thalesgroup.com
McGroarty, Chris (2019)		christopher.j.mcgroarty.civ@mail.mil
Mclean, Thom (Angus) (2018)		thom@gatech.edu
Stevens, John (2019)		john.stevens@coleengineering.com
Gustavson, Paul (X)	CC Chair	pgustavson@simventions.com
<u>Liaisons:</u>		
Bailey, Grant	NATO MSG	grant.bailey.127@mod.gov.uk

SIW TRACKS

The workshop structure for 2018 Winter SIW has been organized into three tracks. SIW tracks provide an opportunity for members of the Modeling and Simulation (M&S) community who share common interests and/or are involved in similar activities or are members of similar organizations to network, exchange ideas and information, introduce new M&S technologies, share lessons learned, and to identify where standardization will improve simulation interoperability and the efficient and effective use of M&S resources and tools.

At the 2018 Winter SIW, the SIW tracks comprise the following:

SYSTEM LIFECYCLE AND TECHNOLOGY TRACK

The System Lifecycle and Technologies (SLT) track encompasses information that provides guidance on the selection and use of M&S standards and practices to support the System Lifecycle and corresponding technologies. The track focuses on the promotion and use of M&S standards and practices that support the system lifecycle. We solicit papers that address the identification, application, and value-added benefits of M&S for analysis, research and development, test and evaluation, training, acquisition, asset management, and system lifecycle strategies.

2017- SLT Planning & Review Panel

These Planning & Review Panel (PRP) members reviewed abstracts/papers designated for the SLT track.

Johnston, Scott	Booz Allen Hamilton	johnston_scott@bah.com
Konwin, Kenneth	Booz Allen Hamilton	konwin_kenneth@bah.com
Halinski, Thomas	CAE, USA Inc.	thomas.halinski@caemilusa.com
Oates, William	AFAMS	william.oates@us.af.mil

Newly Elected 2018 - SLT Planning & Review Panel Members

The following are newly elected members of the SLT PRP.

Halinski, Thomas	CAE, USA Inc.	thomas.halinski@caemilusa.com
Johnston, Scott	Booz Allen Hamilton	johnston_scott@bah.com
Gravitz, Peggy		pgravitz@gmail.com
Vacancies (4)		

SERVICES, PROCESSES, TOOLS AND DATA (SVCS) TRACK

The Services, Processes, Tools, and Data (SVCS) track encompasses technologies, frameworks, and methodologies to provide services that support models, simulations, and associated data. The track is interested in both processes and their implementations / tools in the areas of; distributed simulation process, verification, validation, and accreditation; communications infrastructure; and simulation and environment reuse. The SVCS track focuses on evolving a systems engineering solution to simulation problems across the spectrum from design, through implementation and deployment, to validation, use, and reuse.

2017- SVCS Planning & Review Panel

These Planning & Review Panel (PRP) members reviewed abstracts/papers designated for the SVCS track.

Igarza, Jean-Louis	Antycip Simulation	jeanlouis.igarza@icloud.com
Morse, Katherine L.	JHU/APL	katherine.morse@jhuapl.edu
Saunders, Randy	JHU/APL	r.saunders@ieee.org
Siegfried, Robert	aditerna GmbH	robert.siegfried@aditerna.de

Newly Elected 2018 - SVCS TRACK Planning & Review Panel Members

The following are newly elected members of the SVCS PRP.

Igarza, Jean-Louis	Antycip Simulation	JeanLouis.Igarza@icloud.com
Hodicky, Jan	University of Brno	jan.hodicky@seznam.cz
Morse, Katherine L.	JHU/APL	katherine.morse@jhuapl.edu
Saunders, Randy	JHU/APL	r.saunders@ieee.org
Siegfried, Robert	aditerna GmbH	robert.siegfried@aditerna.de
Voogd, Jeroen	TNO Defence and Security	jeroen.voogd@tno.nl
Vacancy (1)		

MODELING & SIMULATION SPECIALTY TOPICS TRACK

The M&S Specialty Topics (SPEC) track is concerned with using simulation technologies for a specific purpose such as: LVC interoperability; augmented reality; Internet of Things (IoT) integration, system, vehicle, or weapon product development; space travel; understanding and prediction of human behavior; and design of interoperable command and control systems. Present thrust areas center on the application of M&S for Cyber Warfare, Medical, Space, and IoT, but the forum is not limited to these topics.

2017- SPEC Planning & Review Panel

These Planning & Review Panel (PRP) members reviewed abstracts/papers designated for the SPEC track.

Galvin, Kevin	Thales Research & Technology	kevin.galvin@btinternet.com
Lemmers, Arjan	Netherlands National Aerospace Lab	arjan.lemmers@nlr.nl
Meyer, Sara	453 EWS/EWO	sara.meyer.1@us.af.mil
Sanders, Chuck	DMSCO	charles.g.sanders.ctr@mail.mil
Waag, Gary	Engility Corporation	gary.waag@EngilityCorp.com

Newly Elected 2018 - SPECS TRACK Planning & Review Panel Members

The following are newly elected members of the SPEC PRP.

van den Berg, Tom	TNO Defence, Security, & Safety	tom.vandenberg@tno.nl
Galvin, Kevin	Thales Research & Technology	kevin.galvin@btinternet.com
Lemmers, Arjan	Netherlands National Aerospace Lab	arjan.lemmers@nlr.nl
Meyer, Sara	453 EWS/EWO	sara.meyer.1@us.af.mil
Vacancies (3)		

STANDARDS ORGANIZATION LIAISONS

Institute of Electrical and Electronics Engineers - Katherine L. Morse (SAC) – katherine.morse@jhuapl.edu

1. Distributed Interactive Simulation (DIS)
2. High Level Architecture (HLA)
3. Distributed Simulation Engineering & Execution Process (DSEEP)

International Organization for Standardization - Katherine L. Morse (SAC) – katherine.morse@jhuapl.edu

1. Spatial Reference Model (SRM)
2. Environmental Data Coding Specification (EDCS)

North Atlantic Treaty Organization

Wim Huiskamp (EXCOM) - wim.huiskamp@tno.nl

Grant Bailey (SAC) - grant.bailey.127@mod.gov.uk

On 24 July 2007, NATO and the SISO signed a formal Technical Cooperation Agreement for coordination and cooperation in the development of M&S standards. The agreement, signed at the Collaboration Support Office of the Science & Technology Organization of NATO just outside Paris, officially recognized SISO as an accredited Standards Development Organization for NATO.

STUDY GROUPS

<https://www.sisostds.org/StandardsActivities/StudyGroups.aspx>

Exploration of Next Generation Technology Applications to Modeling and Simulation (ENGTAM) SG

Cloud-based Modeling & Simulation (CBMS) SG

Cyber Modeling & Simulation SG

PRODUCT DEVELOPMENT & SUPPORT GROUP COMBINED

<https://www.sisostds.org/StandardsActivities/DevelopmentGroups/C2SIMPDGPSG-CommandandControlSystems.aspx>

Command and Control Systems - Simulation Systems Interoperation (C2SIM) PDG/PSG

PRODUCT DEVELOPMENT GROUPS

<https://www.sisostds.org/StandardsActivities/DevelopmentGroups.aspx>

Acquisition Modeling and Simulation Standards Profile (ACQMS) PDG

Distributed Debrief Control Architecture (DDCA) PDG

Enhanced Position Location Reporting System including Situational Awareness Data Link Simulation Standard (EPLRS/SADL) PDG

Gateway Description and Configuration Languages (GDACL) PDG

Guideline on Scenario Development (GSD) PDG

High Level Architecture (HLA) PDG

Link 11 A/B Simulation Standard Network (Link 11 A/B) PDG

Human Performance Markup Language (HPML) PDG

Reuse and Interoperation of Environmental Data and Processes (RIEDP) PDG

Space Reference Federation Object Model (SRFOM) PDG

Simulation Reference Markup Language (SRML) PDG

Interoperability Between Web-based Federates and LVC Federations (WebLVC) PDG

Urban Combat Advanced Training Technologies (UCATT) PDG

PRODUCT SUPPORT GROUPS

<https://www.sisostds.org/StandardsActivities/SupportGroups.aspx>

Base Object Model (BOM) PSG

Common Image Generator Interface (CIGI) PSG

Core Manufacturing Simulation Data (CMSD) PSG

Distributed Interactive Simulation / Real-time Platform Reference Federation Object Model (DIS / RPR FOM) PSG

Distributed Simulation Engineering and Execution Process/Multi-Architecture Overlay (DSEEP/DMAO) PSG

Environmental Data Representation Standards (EDRS) PSG

Federation Engineering Agreements Template (FEAT) PSG

High Level Architecture - Evolved (HLA-Evolved) PSG

Tactical Digital Information Link–Technical Advice and Lexicon for Enabling Simulation (TADIL TALES) PSG

Verification, Validation & Accreditation/Acceptance Products (VV&A Products) PSG

SPECIAL WORKING GROUPS

<https://www.sisostds.org/StandardsActivities/StandardsActivityCommittee.aspx>

Reference for Enumerations for Simulation (SAC SWG Enumerations)

Reference for Problem Report / Change Request (SAC SWG PR/CR)

Reference for XML Schema Naming and Design Best Practices (SAC SWG XML Schema)

18W- SIW-002

FRENCH IMPROVEMENT OF SIMULATION INTEROPERABILITY BY USING ABSTRACTION LAYER APPROACH

This paper is being presented: Wednesday, Salon 3, 1130-1200, SVCS Track

Primary Author: Jose Ruiz

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Abstract: In order to support the interoperability of simulations, standards have been defined and used for the last three decades (Distributed Interactive Simulation, High Level Architecture, etc.). Each standard is valuable depending on its context of use (real time, flexible data model, etc.). When you develop new simulations or reuse legacy ones, it is difficult to foresee all use cases your system will have to support. The dream would be to design the interoperability interface of your simulation as modular as possible, in the aim of assembling the relevant standard interoperability blocks when you need them, without modifying each time the linkage to your internal models.

To reach this goal, an abstraction layer is an interesting approach because, thanks to a generic API (Application Programming Interface), you can expose your data models and services in a unique way and delegate the data mapping and distribution to external reusable components, compliant with simulation interoperability standards or also with other interoperability middleware (e.g. Data Distribution Service). The advantage of this generic API is also its use of an incremental set of services, which enables to interoperate at various levels, evolving from a simple functional basis to a progressively more sophisticated set of features. Such features include the configuration and the control of a distributed simulation (start, stop, pause and resume), the collect of logs, data mapping and distribution, time management and so on. Finally, this kind of solution can leverage a model driven approach, which enables (with the relevant tooling) to design architectures using these interoperability services, configure their deployment and generate runtime resources (data, code, etc.).

France started the experience of abstraction layers in the field of simulation fifteen years ago and implemented them in interoperability support systems. The recent one called ELLIPSE is actually used in the French Ministry of Defense as support for technical studies and military training activities. The current paper covers the content of the new abstraction API, the description of the simulation interoperability services using this API, the explanation of technologies used to implement these services and the feedback of the ELLIPSE system in a practical use case.

18W- SIW-003

PREDICTING PILOT PROFICIENCY WITH INTEROPERABLE HUMAN PERFORMANCE ASSESSMENT

This paper is being presented: Wednesday, Salon 2, 0830-0900, SLT Track

Primary Author: Peter Neubauer

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Abstract: Assessments of human performance during live and virtual training are essential to adapting limited training resources to best meet trainee needs. However, human performance assessment methods, whether objective or subjective, are often not interoperable, and it is difficult to fuse the various assessments to obtain a comprehensive understanding of human performance. The Common Data Access

system, a tool for archiving and translating distributed simulation data, has been extended with the capability to translate traditionally incompatible human performance assessment data formats into a common format. A new software tool, the Predicting, Analyzing, and Tracking Training Needs system, applies machine learning techniques to this new combined data warehouse and is producing promising early results for predicting pilot proficiency, training impact, and skill decay. With these new insights, training could be more efficient and more effective. Automated training systems could better adapt as trainee needs evolve. This paper outlines our method for fusing data from disparate assessment systems, compares and contrasts approaches to analyzing the combined data, and suggests directions for ongoing research and development.

2018 Winter 'SIWzie' Awarded paper

18W- SIW-004

USING THE DISTRIBUTED SIMULATION ENGINEERING AND EXECUTION PROCESS (DSEEP) AS A GUIDE FOR RESEARCH AND PROTOTYPE CONCEPTUAL MODELING

This paper is being presented: Tuesday, Salon 2, 0830-0900, Best Paper Forum

Primary Author: Eric Whittington

Email: eric.whittington@jhuapl.edu

Abstract: The Department of Defense (DoD) has mandated the use of the joint capability areas (JCAs) structure to “serve as the Department’s common framework and lexicon for the organization of capability portfolios.” Independent Services are attempting to reorganize and explore ways to implement JCAs within their institutional processes and procedures. One of the major enablers for each Service’s capability development efforts is the operations research analyst and modeler. Currently a variety of tools and campaign models are used to support an analytic agenda and influence science and technology investments. However, some of these tools and models are extremely complex and time consuming to execute over several months to provide key insights for decision makers. Selection of the correct area of the problem space to analyze is a critical decision that needs to be examined.

The Headquarters United States Air Force Studies, Analyses and Assessments (AF/A9) is exploring the development of an analysis screening tool that may rely on modeling and simulation (M&S) to produce useful insights for Joint force planners and analysts. The IEEE Std 1730™-2010, IEEE Recommended Practice for Distributed Simulation Engineering and Execution Process (DSEEP) purpose “is to describe a generalized process for building and executing distributed simulation environments.” This has mainly been the focus of large and extremely complex distributed simulation environments with several disparate stakeholders, but the DSEEP still offers researchers and prototype developers a validated process as a starting point to follow when investing limited proof of concept resources. This paper will discuss the lessons learned of using the DSEEP to guide artifact generation, cross-organization communication, and completeness of defined activities discovered during the exploratory research of mapping JCAs with portfolio management across multiple DoD analysis stakeholders.

18W- SIW-005**MAKING FIXED GRID DDM HLA 4 COMPLIANT: THE BENEFITS OF A FIXED GRID DDM IMPLEMENTATION AND A WAY FORWARD IN HLA 4**

This paper is being presented: Wednesday, Salon 3, 1630-1700, SVCS Track

Primary Author: Felix Rodriguez

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Abstract: In this paper, we present a proposal for the relaxation of the DDM specification to allow a usable fixed grid implementation to be compliant with the HLA Interface Specification.

DDM provides a powerful mechanism for filtering HLA interactions and object updates in a generic and flexible way. In practice however, a casual design of DDM in a federation can easily degrade RTI and federation performance rather than improve it. To fully satisfy the DDM requirements called out in the HLA Interface specification requires the RTI to exchange region information between RTI components. This can lead to ruinous overhead if federates are making frequent changes to region range bounds or region associations. The fixed grid approach for implementing DDM in an RTI can drastically reduce this overhead while not significantly increasing post receive filter processing in federates. However, it does so at the expense of circumventing some of the DDM requirements in the HLA Interface Specification.

In this paper, we will describe a typical application of DDM for real-time platform level simulations to support geographic filtering. Using our insight in developing and supporting the VT MAK RTI, we will provide evidence of how casual design of DDM in a federation without knowing the underlying DDM implementation in the RTI can lead to ruinous overhead. An overview of the fixed grid approach for implementing DDM will be given. We will show how this approach supports the basic geographic filtering requirements while eliminating the largest factor impacting RTI performance, exchanging region information between RTI components. We will also explain how the fixed grid implementation does not add significantly more filtering of received data by the federate over alternative DDM implementations. Unfortunately, the advantage of eliminating the overhead of exchanging region information comes at the cost of not satisfying several requirements in the HLA Interface Specification. We will conclude the paper with a proposal for the relaxation of the DDM specification to allow a usable fixed grid implementation to be compliant with the HLA Interface Specification.

18W- SIW-006**CONTAINER ORCHESTRATION ENVIRONMENTS FOR M&S**

This paper is being presented: Tuesday, Salon 3, 1430-1500, SVCS Track

Primary Author: T.W. van den Berg

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Abstract: Deployment and execution of HLA federates in Docker containers offers many benefits. However, managing the execution of multiple HLA federate containers to run a complete HLA federation across a set of compute nodes in a local area network or in a cloud environment can be time consuming and error prone. A small HLA federation can easily consist of ten or more containers and it quickly becomes impossible to oversee these containers without proper tools to orchestrate them. Tools to support the orchestration of containers exist and reduce the effort required to configure, coordinate, and manage

containers. Many of these tools are open source, are freely available and evolve quickly. The most popular ones include Docker Native tools from Docker Inc. and Kubernetes from Google.

In an earlier SISO paper (16F-SIW-031), guidelines and best practices for containerizing HLA applications were presented. This paper discusses the topic of container orchestration environments for M&S, in particular for containerized HLA applications. Topics covered in this paper include the following: what is required to effectively deploy a HLA federation via an orchestration tool? What orchestration solutions are available and what benefits/challenges do each provide?

By the end of this paper the reader should have a good idea of what is available, what is needed, and how to use orchestration tools to field a HLA federation. This paper provides orchestration solutions that can be equally well used for simulation technology other than the HLA.

2018 Winter 'SIWzie' Awarded paper

18W- SIW-007**SIMULATION INDEPENDENT MODEL CONFIGURATION**

This paper is being presented: Wednesday, Salon 3, 0900-0930, SVCS Track

Primary Author: T.W. van den Berg

Email: tom.vandenberg@tno.nl

Abstract: The models of all entities involved in a simulation need to be configured to behave in line with the purpose of the scenario. Simulation model configuration is quite complex for several reasons. For one, a simulation model such as a human behavior model or a sensor model has many detailed parameters and specialist knowledge is needed to configure and use these models appropriately. The people that develop scenarios for simulation systems are seldom specialists in the underlying simulation models. Moreover, different simulation systems that model the same or similar concept like a human or a specific type of vehicle, in practice all use different models and model configuration parameters. Configuration parameters for similar concepts have different names or meanings in different systems and simulation model configurations cannot be exchanged between simulation systems.

This paper investigates the concept and envisioned use of a so called "Simulator Independent Model Configuration" (SIMC) language based on the ontology language OWL to describe simulation model configurations in a simulation system independent way. Using the SIMC language it should, for example, be possible to model system-neutral simulation model configurations that can be translated into system-specific simulation model configurations in a systematic fashion. Furthermore, the semantic properties of OWL should open possibilities for reasoning about concepts, properties and parameters, and should provide the capability to infer further information. This paper presents several use-cases and an analysis of a case study to evaluate the suitability of the OWL language for defining simulation models configurations.

18W- SIW-008

CONFIGURABLE ADVERSARY RESPONSE PREDICTION: BUILDING EFFICIENT EXPECTATION MODELS FROM HIGH-FIDELITY BEHAVIOR SIMULATIONS

This paper is being presented: Wednesday, North 2, 0930-1000, SPEC Track

Primary Author: Randolph Jones

Email: rjones@soartech.com

Abstract: The Air Force has an interest in a run-time mission pilot's assistant that will support tactical pilots in the rapid assessment of information quality and reconsideration of decisions that the information supports. Such a capability requires an efficient, predictive knowledge base that enables rapid situation assessment and decision support. The Configurable Adversary Response Prediction (CARP) project addresses two key technical challenges to the development of the pilot's assistant. The first is to extend and exploit the state of the art in modeling and simulation, particularly in the modeling of human decision making, to support simulation of scenario and mission outcomes that provide the analytical forecasts necessary to perform situation assessment. The second is to represent the results of these analyses in an efficient knowledge base that can create assessments in real time, overcoming the difficulty of running large-scale analyses during mission execution.

The output of the CARP application will be sets of behavior envelopes that align expected observations with assumptions about adversary goals and tactics. These envelopes will provide a knowledge base that allows the pilot's assistant to rapidly identify mismatches between assumptions, awareness, and observations. CARP will produce this efficient knowledge base through collaborative exploration of predictive behavior spaces, using a guided user interface for experimenting with realistic simulations and summarizing their predictive outcomes. CARP's simulation testbed will be a robust integration and adaptation of predictive simulation systems and models. The testbed provided by CARP will allow the use of the most accurate available models, together with tools to support and adapt model parameters to improve predictions, and then to aggregate simulation results into behavior envelopes, which encapsulate expected observed behaviors in varied situations. To prove the concept, we are working in collaboration with TiER I and EduWorks, who are developing innovative technologies for high fidelity simulation-based modeling of adversary decision making. The paper describes our work to date, including challenges met and advances made. It also discusses our integration plans for the tactical environment evaluations, which will be the capstone event to the efforts.

18W- SIW-009

MULTI NATIONAL AND JOINT FORCES LIVE, VIRTUAL AND CONSTRUCTIVE DEMONSTRATION

This paper is being presented: Wednesday, Salon 2, 0900-0930, SLT Track

Primary Author: Rachel Vickhouse

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Abstract: The requirement for multi-domain coalition military operations, requires robust and adaptive training environments. Through blending of Live, Virtual and Constructive (LVC) entities in training environments, we can create environments for Warfighters

to train like the fight. The Warfighter Readiness Research Division from Air Force Research Laboratory at Wright-Patterson Air Force Base recently hosted a multi-national joint services large scale LVC demonstration. "Cleared Hot! LVC Coming to a Range Near You" took place at the 2016 Interservice/ Industry Training, Simulation, and Education Conference (I/ITSEC) in Orlando, Florida. Cleared Hot brought together a variety of training capabilities in a set of realistic scenarios. International partners from the Swedish Air Force Simulation Centre in Stockholm, Sweden along with live participants at Muscatatuck and Jefferson Proving Ground in Indiana, and virtual players from 5 exhibitor locations on the show floor showcased real-time, LVC entity interoperability in various postures across a seamless environment supported by operational warfighters while defending against constructive entities in a contested environment. Cleared Hot participants included: live A10s, live JTACs, virtual A-10, virtual Joint Theater Air Ground Simulation System (Air Support Operations Center), virtual Distributed Ground Station (DGS) Weapons System Trainer (WST), virtual deployable Joint Terminal Attack Controller (JTAC) Training Rehearsal System (TRS), virtual Predator Reaper Integrated Network Combat Environment (MQ-9), virtual F-16 cockpits, virtual JAS-39 Gripen, virtual Airborne Warning and Control System (AWACS), and multiple constructive entities. This paper will highlight key activities, challenges, describe lessons learned, and will discuss how the demonstration serves as a significant foundation for future multi-domain, multinational and Joint LVC training exercises.

18W- SIW-011

TACTICAL PILOT ASSISTANT AND DENIED ENVIRONMENTS: INCORPORATING SOCIO-TECHNICAL FACTORS IN SIMULATIONS

This paper is being presented: Wednesday, North 2, 1100-1130, SPEC Track

Primary Author: William Clancey, PhD

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Abstract: Tactical pilot assistants will incorporate artificial intelligence (AI), advanced human-systems interaction, and networked access to data and sensors to provide decision aiding of unprecedented sophistication. In conventional air combat scenarios, a tactical pilot assistant could, for instance, monitor aircraft systems, interpret and carry out pilot commands, and advise the pilot as to systems status, mission progress, and threats. Such agents are particularly valuable during operations in contested environments, where pilots may be subject to denied communications, spoofed navigation systems, and other forms of electronic warfare (EW) disruptions. In Anti-Access/Area Denial (A2AD) contexts, the tactical pilot assistant could alert the pilot when denial attacks such as datalink jamming or GPS spoofing are detected and recommend countermeasures. A2AD effects could also degrade the integrity of the tactical pilot assistant itself, motivating systemic simulations early in design.

The functions of a tactical pilot assistant and the pilot go well beyond the mechanics of maneuvering the aircraft. Tactical pilot assistants and their human pilots are part of a socio-technical system, where people and agents are inherently part of a network of operations that may involve ambiguous communications and dynamic roles and responsibilities. Combat sorties, for example, require considerable interaction within and across aircraft and remotely with people and agents on the ground. Developing, testing and integrating a tactical pilot assistant requires simulations that capture the complexities and vulnerabilities of an

information-rich, networked, digital, automated world. Simulations that reflect socio-technical processes are needed to model the effects of human-automation interaction under both nominal and off-nominal conditions. Socio-technical context is not just a backdrop for simulation, but must be an explicit factor in a tactical pilot assistant's threat assessments and course of action recommendations. Detecting and overcoming problems with socio-technical lapses, whether benign or the result of hostile action, is one example. Communications and data disruptions, as in combat forces operating under conditions of denied access to information, can also have devastating emergent effects on the way people and intelligent systems work together.

Simulating how people and automated systems interact in an uncertain, dynamic environment provides analysts and planners with a tool to assess risk and design and evaluate countermeasures, in particular, a tactical pilot assistant that enables a pilot to fight through such events. Simulations are thus needed that can properly capture work practices of the socio-technical system.

To address this need, we adopt a socio-technical approach to simulating activity, namely situated, interactive behavior, that includes a spatial/geographical model, cultural features and objects, and information systems. In this paper, we present our simulation methodology that captures the activities of individuals and the socio-technical context. We describe current research in support of a tactical pilot assistant that employs this simulation approach for predictive analysis and constructive agent control in simulations of uncertain, complex threats. This work, in concert with related research contributing complementary capabilities, will accelerate the development of a robust tactical pilot assistant.

18W- SIW-012

SURVEY OF CYBER SECURITY FRAMEWORK ACROSS INDUSTRIES

This paper is being presented: Tuesday, North 2, 1430-1500, SPEC Track

Primary Author: Ambrose Kam

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Abstract: For many years, cyber security in both Department of Defense (DoD) and civilian industries has been a compliance driven process. Respective organizations define rules or best practices that direct their Information Technology (IT) systems to comply to. Success is often measured by how well these static rules are followed, and how many security incidents have been discovered compared to historical data. There is a multitude of problems associated with this simplistic approach. First, cyber threats are constantly evolving; it was previously estimated that as many as 400,000 new malware are being introduced each day. Most of these threats are specifically targeting a given system and/or designed to succeed in certain attack vector. Adapting a cookie-cutting, one-size-fits-all cybersecurity policy that only gets reviewed/updated periodically might not be adequate. From the technical standpoint, even the best commercial-off-the-shelf (COTS) anti-virus/anti-malware software relies on regular database updates of known threats. Hence, by definition, these forms of protection can only provide remediation for existing threats; systems are basically defenseless against specific zero-day threats that are specifically designed to attack these systems. A more comprehensive approach toward cybersecurity should be adapted to defend against these evolving threats. With the pervasive nature of the Internet, previously disparate industries are now more interwoven together than ever before. In the United

States, if a cyber attack is to happen in the power grid infrastructure, it is conceivable the impacts could be spread to public safety, health, national defense, banking and finance sectors. Not only might impacts be felt across industries, but the threat profiles of these attacks may hold similarities as well due to common vulnerabilities across IT and Operation Technology (OT) systems. Hence, it is crucial to determine how different industries are addressing the cybersecurity challenges they are each facing.

This paper will provide a brief survey of best practices in cybersecurity in several industries, including DoD, oil/gas industries and banking/financial institutions. There are a lot of similarities in the way these industries are each approaching the cybersecurity challenges. At the same time, there are significant differences in the specific threats they are facing. For example, the DoD is beginning to shift its focus from generic penetration tests and risk management framework evaluations to using cyber range testing and simulation-based threat assessment that systematically evaluate military systems and platforms under a variety of operational conditions. The oil/gas energy companies are also starting to identify their most vulnerable systems and subsystem components. For example, they work with industrial control system (ICS) vendors and suppliers to improve their products' cybersecurity performance--both at the individual unit level as well as the network protocol layer. The banking and financial institutions are facing cyber attackers with different motivations than those targeting the DoD systems. Instead of crippling or destroying the targeted systems, the cyber criminals in the banking/financial industries are often more focusing on deception and data exfiltration, even though they also use similar tactics, techniques, procedures (TTP) such as phishing, waterhole attack, etc. like the cyber attackers in other industries.

18W- SIW-013

MODELING CYBER SECURITY

This paper is being presented: Tuesday, North 2, 1600-1630, SPEC Track

Primary Author: Ambrose Kam

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Abstract: Cybersecurity threats are growing exponentially over the past few years. In 2016 alone, it was estimated that there were over 100 million cyber attacks conducted globally incurring a business cost of over \$900 Billion in losses. This correlates to the fact that the "barrier to entry" for individuals interested in carrying out cyber attacks to institutions and even country states is lower than ever before. Malware and malicious software are available for download for less than the cost of a video game. Yet, cyber attacks can have devastating impacts—from losing someone's savings /credentials to causing social and economic chaos through disruption of the national power grid service. This has called for better cybersecurity techniques to improve the defensive posture of critical infrastructure. Network/host intrusion detection systems and commercial-off-the-shelf (COTS) anti-virus and anti-malware products provide only baseline defenses. Many of these products are reactive in nature, and are effective only against existing known threats. As a result, it is critical to evaluate cyber threats before they are being launched against their specific targets. One way to handle these what-if conditions can only be addressed through modeling and simulation (M&S). Lockheed Martin is applying advanced M&S-based Prediction and Operations Analysis (OA) expertise to the cybersecurity domain area. Through research and development, the team has put

together a suite of M&S tools aimed to better address cybersecurity challenges from individual packet level to mission effectiveness level. Network Oriented Cyber Security Model (NOCSM) suite has now been used to support cyber threat assessment by analyzing various possible attack vectors. Through collaboration with leading universities in the cyber space (including Massachusetts Institute of Technology and Georgia Tech), the team has amassed valuable insights, and applied them to its portfolio of cyber simulation tools. This paper will describe the latest development as well as the novel application of the tool set.

18W- SIW-015

TOWARD A TACTICAL PILOT'S ASSISTANT: A FRAMEWORK FOR INTEGRATING MODELS OF INTELLIGENT BEHAVIOR

This paper is being presented: Wednesday, North 2, 1030-1100, SPEC Track

Primary Author: Walter Warwick

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Abstract: Historically, cognitive modeling has been an exercise in theory confirmation. Cognitive architectures were advanced as computational instantiations of theories that could be used to model various aspects of cognition and then be put to empirical test by comparing the simulation-based predictions of the model against the actual performance of human subjects. More recently, cognitive architectures have been recognized as potentially valuable tools in the development of software agents by providing intelligent behavioral primitives that can either reproduce or support human performance in complex domains. While the introduction of cognitive architectures to what has been regarded as the exclusive province of artificial intelligence is a welcome turn, the traditional methods of cognitive modeling are hard to ignore. In particular, there is a tendency to apply cognitive architectures as monolithic, one-off solutions. This runs counter to many of the best practices of modern software engineering, which puts a premium on developing modular and reusable solutions. In this paper, we describe the development of a novel software infrastructure that supports interoperability among cognitive architectures. Our motivation is to allow the analyst to choose the right tool for the job, so to speak, by promoting the decomposition of agent behaviors so that cognitive architectures can be applied in a piecemeal manner with the requirements of the behavior driving the choice of architecture. In this way, we stand tradition on its head and compel the analyst to think carefully about the various ways a behavior might be modeled and, by extension, how those models are best encapsulated so that they can interoperate and, potentially, be reused. After describing the infrastructure, we report on an ongoing effort to use it for the development of a complex "tactical pilot's assistant." We are collaborating with researchers at Soar Technologies and Eduworks to understand how otherwise distinct agent technologies might be combined. Specifically, we are exploring how a model of agent perceptions can be combined with a diagnostic reasoning module to assist a pilot in generating and verifying expectations about a tactical situation. In addition to overcoming the practical challenges of model integration, this effort entails a richer theoretical challenge of determining a useful division of labor among agent models and the human pilot they are designed to support.

18W- SIW-016

EXTENDING THE DEFENSE MODELING AND SIMULATION REFERENCE ARCHITECTURE THROUGH PATTERNS

This paper is being presented: Tuesday, Salon 3, 1530-1600, SVCS Track

Primary Author: Katherine L. Morse, PhD

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Abstract: In July 2016 the Defense Modeling and Simulation Coordination Office (DMSCO) released the Defense Modeling and Simulation Reference Architecture (DMSRA). In support of the DMSCO mission of "fostering the interoperability, reuse, and affordability of crosscutting M&S to provide improved capabilities for DoD operations." the goals of the DMSRA are to: establish a long term strategic vision for DoD M&S interoperability; and provide a set of best practices for today that are consistent with achieving that vision in the future. The paper focuses on those best practices contained in the DMSRA Patterns section. Specifically, the patterns detail the key considerations an M&S developer or decision maker needs to take into account when developing a new or updating an existing simulation for a specific DMSRA topic. Pattern topics include cloud migration, simulation decomposition, verification and validation of modular components, and service oriented architecture. The paper will also describe the way forward for the document and the addition of new patterns.

18W- SIW-018

MODELLING AND SIMULATION AS A SERVICE: RAPID DEPLOYMENT OF INTEROPERABLE AND CREDIBLE SIMULATION ENVIRONMENTS – AN OVERVIEW OF NATO MSG-136

This paper is being presented: Wednesday, Salon 3, 0830-0900, SVCS Track

Primary Author: T.W. van Den Berg

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Abstract: NATO and nations use distributed simulation environments for various purposes, such as training, mission rehearsal and decision support in acquisition processes. Consequently, Modeling and Simulation (M&S) has become a critical capability for the coalition and its nations. Achieving interoperability between participating simulation systems using different technologies and ensuring credibility of results currently requires often enormous efforts with regards to time, personnel and budget.

Recent technical developments in the area of cloud computing technology and Service Oriented Architecture (SOA) may offer opportunities to better utilize M&S capabilities in order to satisfy NATO critical needs. A new concept that includes service orientation and the provision of M&S applications via the as-a-service model of cloud computing may enable more composable simulation environments that can be deployed on-demand. This new concept is known as M&S as a Service (MSaaS). NATO MSG-136 ("Modelling and Simulation as a Service – Rapid deployment of interoperable and credible simulation environments") is a working group of the NATO Modelling and Simulation Group (NMSG) that investigates the concept of MSaaS with the aim of providing the technical and organizational foundations for a future permanent service-based M&S environment within NATO and partner nations.

This paper provides an overview of the activities performed by MSG-

136 and presents the preliminary results achieved, from the following perspectives:

- Operational: the operational concept for M&S as a Service: how does it work from the user's point of view;
- Technical: the technical concept of M&S as a Service, covering reference architecture, service metadata, and engineering process. This discussion also covers how existing simulation systems may be used following an MSaaS approach.
- Governance: the governance concept and roadmap for M&S as a Service within NATO;

The MSG-136 results will feed into current SISO activities, such as the SISO Cloud-based M&S Study Group. The authors expect that MSaaS recommendations will lead to future M&S interoperability standards.

18W- SIW-019

CREATING A TACTICAL PILOT'S ASSISTANT FOR COMBAT OPERATIONS IN CONTESTED DENIED ENVIRONMENTS: AN OVERVIEW OF THREE APPROACHES

This paper is being presented: Wednesday, North 2, 0900-0930, SPEC Track

Primary Author: Winston Bennett, Jr, PhD

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Abstract: As our adversaries become more capable in their development of advanced systems for combat, those systems themselves are becoming increasingly complex as well. The future battlespace is expected to be one where the mechanisms and tools we depend on today for the execution of a combat mission will not be reliable in terms of the real world representations they provide, given creative manipulation of sources and data. Less elegant approaches to contesting and denying operations merely take a given source of data or capability away. A far more sophisticated approach is one that does very subtle manipulation of key data and representations, such that even the ops systems may not detect miscorrelation or suspect data, thus requiring the human operator, under stress to do those detections and assessments. There may also be such a variety of information that the human operator will not be able to evaluate the quality or "truth" of the data in real time, and may be forced to make decisions on deficient or suspect sources and data. Further, the density of data from the variety of sensors and sources at hand will potentially overwhelm human operators just dealing with the regular influx of data. With this in mind, a major goal of this effort is to examine the extent to which we can use emerging human behavior and machine learning models to create software-based pilot's assistance that can help offload some of the source and data monitoring from the human operator and to alleviate cognitive bottlenecks in the midst of a combat engagement. Three different approaches to the development of an agent-based assistant will be described and discussed across this and the three other companion papers. This initial paper will serve to frame the other presentations and provide a practical foundation for the approaches that have been undertaken. We will highlight the key activities, challenges and development efforts to this point and will describe the applications space we will demonstrate the models in over the next few months. The capstone demonstration where each of the approaches will be evaluated will be described and discussed. The end state will be an integration into an F16 tactical training environment and evaluated within the context of tactical performance in a contested environment where such data sources as GPS and tactical datalinks, among others, are likely to be suspect and lead to erroneous human

decision making in the absence of the assistant's support and advice.

18W- SIW-021

UNIVERSAL CPS ENVIRONMENT FOR FEDERATION (UCEF)

This paper is being presented: Tuesday, North 2, 1530-1600, SPEC Track

Primary Author: Martin Burns

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Abstract: NIST in collaboration with Vanderbilt University has assembled an open-source tool set for designing and implementing federated experiments for cyber-physical systems. We intend to use these capability in our research on CPS at scale for IoT and Smart Cities.

2018 Winter 'SIWzie' Awarded paper

18W- SIW-022

CHALLENGES OF DEVELOPING AND DEPLOYING ISR TRAINING TO THE FLEET

This paper is being presented: Tuesday, North 2, 1330-1400, SPEC Track

Primary Author: Mark Thomas

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Abstract: Developing and deploying realistic synthetic Intelligence, Surveillance, and Reconnaissance (ISR) capabilities within an established operational training framework poses many challenges. During Fleet Synthetic Training (FST) many warfare areas are stimulated and trained. As technology improves new capabilities are incorporated to provide more accurate training. This paper discusses the challenges encountered during the development, integration, and adoption of the Navy Continuous Training Environment's (NCTE) Full Motion Video (FMV) utilized to train Intelligence Specialists and staffs. The Realtime Automated Visualization Environment (RAVE) simulates real world video producing sensors and streams the dynamically generated FMV to operational systems. RAVE is a core component of the Navy Training Baseline (NTB) and is actively used in Navy training and experimentation. RAVE went through several iterations from its first use in FST in September 2012 to providing globally distributed FMV. Several innovative capabilities were developed to generate and stream FMV over training and operational networks to support large scale Navy training. This effort included developing an agile native High Level Architecture (HLA) interface for a commercial off the shelf (COTS) game engine and leveraging operational global video dissemination services. While the technology is a key component of providing FMV, this paper also discusses the challenges associated with the adoption of the capability to support Navy training.

18W- SIW-023

USING GAME ENGINES TO BUILD VIRTUAL TRAINING ENVIRONMENTS

This paper is being presented: Tuesday, Salon 2, 1600-1630, SLT Track

Primary Author: Timothy Rodabaugh

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Abstract: Spurred on by the explosive growth of the video game market, game engine technology advances at a breakneck pace. Environments that once required a large team of artists, designers, and programmers to create can now be accomplished by a small team or even an enterprising individual. Stiff competition means that many game engines are very cost effective, if not free. Premade assets and plugins are a cost-effective means of quickly adding content and functionality to a virtual scene. The Gaming Research Integration for Learning Laboratory (GRILL) has used virtual environments constructed in modern game engines as a cost-effective augmentation to Live, Virtual, and Constructive (LVC) training.

This paper summarizes the construction of two virtual environments in Unreal® Engine. The first is an urban environment with different settings and props in which study participants are asked to evaluate levels of trust in various settings. The second is of the 50-acre training site “Calamityville,” located at the National Center for Medical Readiness in Fairborn, OH. Various tools, techniques, and lessons learned from building the two virtual training sites are covered in this paper. Principle elements to build a virtual environment include survey techniques; 3D model construction; integration of models and assets; terrain and landscape development; and, lastly, scripting. By using a game engine and a modern development pipeline rich, high-fidelity, cost-effective environments can be constructed to aid in LVC training.

18W- SIW-024

STATISTICAL TECHNIQUES FOR MODELING AND SIMULATION VALIDATION

This paper is being presented: Tuesday, Salon 3, 1630-1700, SVCS Track

Primary Author: Kelly McGinnity Avery, PhD

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Abstract: In the world of DoD test and evaluation, collecting sufficient data to evaluate system performance against operationally realistic threats is often not possible due to cost and resource restrictions, safety concerns, or lack of adequate or representative threats. Thus, modeling and simulation tools are frequently used to augment live testing in order to facilitate a more complete evaluation of performance. When M&S is used as part of an operational evaluation, the M&S capability should first be rigorously validated to ensure it is representing the real world adequately enough for the intended use. Specifically, the usefulness and limitations of the M&S should be well characterized, and uncertainty quantified to the extent possible. Many statistical techniques are available to rigorously compare M&S output with live test data. This presentation will describe some of these methodologies and present recommendations for a variety of data types and sizes.

We will show how design for computer experiments can be used to efficiently cover the simulation domain and inform live testing. Experimental design and corresponding statistical analysis techniques for comparing live and simulated data will be discussed and compared. A simulation study shows that regression analysis is the most powerful comparison when experimental design techniques are used, while more robust non-parametric techniques provide widely applicable solutions

for the comparison.

18W- SIW-026

LOW COST APPROACHES TO COMBAT HELICOPTER SIMULATIONS AND TRAINING

This paper is being presented: Tuesday, Salon 2, 1630-1700, SLT Track

Primary Author: Frederick C. Webber

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Abstract: Combat rescue helicopter pilots often spend time instructing foreign military pilots on other weapons systems, flight systems, and piloting ability in a deployed environment. This in turn leads to decay in the instructor’s skill set for their primary aircraft. These pilots are expected to maintain currency but have few or no aircraft or opportunities available to help them do so.

In addition, the few state of the art helicopter simulators that adequately simulate the HH60G (Pavehawk) are not deployable, cost effective, and they don’t adequately train retention in all skill sets required for Pavehawk pilots. This paper presents a rapidly developed helicopter flight sim that meets these unmet needs as well as the process by which the simulator was developed. A key factor in the process was the quick feedback from deployed pilots needing this capability. This small system requires minimal infrastructure and engineering support and thus can be deployed to almost any location worldwide where a warfighter has need, thereby enabling the pilot to reduce skill decay.

18W- SIW-027

EXECUTE SMARTER AND MANAGE RISK – APPLY PROVEN STANDARDS

This paper is being presented: Tuesday, Salon 2, 1430-1500, SLT Track

Primary Author: Kenneth (Crash) Konwin

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Abstract: With increasing less money and greater challenges M&S programs and M&S training events must execute smarter and improve the management of risk by applying proven standards and best practices. To address this problem, standards to support a variety of M&S activity requirements have been developed, tested, applied and made available. However, identifying those standards, matching them to required M&S activity requirements and locating documentation and required execution information can be time consuming and expensive. With the insights from users, current programs and training events such Operation Blended Warrior (OBW), the Acquisition Modeling and Simulation Standards Profile Product Development Group (PDG) is in the final stages of development a solution. Information gathered from use cases and vignettes reflects new insight gained from their selection and application of standards. Valuable perspectives into the challenges faced by programs such as OBW provide a richer more realistic understanding how to execute smarter and improve the management of risk. This paper will briefly describe how standards and standardization effort by various organizations came together to ensure our Warfighters can continue to pursue their mission objectives.

2018 Winter 'SIWzie' Awarded paper

18W-SIW-028

GEN3: WHAT'S UP WITH DIS VERSION 8

This paper is being presented: Tuesday, Salon 2, 0930-1000, Best Paper Forum

Primary Author: Robert Murray

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Abstract: The Distributed Interactive Simulation (DIS) support group has been considering an overhaul of Protocol Data Unit (PDU) syntax to achieve significantly better capabilities for the upcoming Version 8 standard. The concept has been dubbed Gen3 because it would result in the third generation of DIS PDU design. This would break compatibility with previous versions of DIS going back to the 1995 standard (Version 5), a decision not to be taken lightly. However, the potential advantages are many. Gen3 has been voted to move forward by the Product Support Group (PSG) for the DIS standard. This paper describes the rationale and design principles of Gen3 PDUs. The primary gain is better extensibility for every PDU. Increasing demands in simulation fidelity require an easier way to add customization and new capability. Every PDU can have a variable record section that allows additional information to be added when needed. This idea was considered for DIS Version 7 (2012) but was narrowly outvoted in favor of maintaining compatibility.

Another advantage of a PDU redesign is simplicity and consistency in PDU format. PDUs for Version 7 and earlier were designed by multiple teams, where each found different and sometimes complex ways to add variability. A simpler PDU format will make it much easier to create a formal syntax description language. A prototype XML schema has already been developed. The so-called machine-readable DIS syntax enables automated PDU processing. For example, it will be possible to create automated code generation of Wireshark dissectors and PDU marshalling code, the means for exercises to agree on and distribute custom records, and automated interoperability with the Real-time Platform Reference Federation Object Model (RPR FOM) and Web Live Virtual Constructive (LVC) object model.

The list of other potential improvements includes: simpler timestamp, sequence numbers to detect dropped and out-of-order PDUs, use of geodetic coordinates, eliminate the ambiguous distinction between entities and objects, eliminate Endian conversion, and eliminate partially redundant PDUs that resulted from restrictions on how the 1998 standard was created. Not every one of these changes is necessary for the success of Gen3. Each will be developed and approved/disapproved separately. This list is by no means complete. More ideas will invariably come forth as developers consider the new possibilities. Breaking compatibility will result in the need for translation between Version 8 and older simulations. Any changes in syntax must be done in a way that makes translation practical and able to be performed in real time. This has been dubbed "translation compatibility" and is one of the highest priorities in the Gen3 design principles. Part of achieving translation compatibility is to avoid changes in semantics (rules of use) from previous versions of DIS. The rules are 70% of the DIS standard and would require an excessive effort to change. Therefore, the rules that already exist in Version 7 will be changed only as necessary for the syntax reformatting.

18W-SIW-029

DEAD RECKONING IN GEODETIC COORDINATES FOR IMPROVED LVC INTEROPERABILITY

This paper is being presented: Wednesday, Salon 3, 1530-1600, SVCS Track

Primary Author: Robert Murray

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Abstract: Geodetic Coordinates are the familiar Latitude-Longitude-Altitude coordinates used by almost all simulations for specifying world location. The familiar Yaw-Pitch-Roll angles are also nearly universal for describing entity orientation. However, Live, Virtual, Constructive (LVC) interoperability going back to the 1995 Distributed Interactive Simulation (DIS) standard uses Geocentric Cartesian Coordinates for both location and orientation, requiring coordinate conversion to and from the internal Geodetic Coordinates.

The Geocentric Cartesian Coordinate system was originally chosen for DIS because it is rectilinear. It is easier to perform dead reckoning and associated math in X-Y-Z rectilinear coordinates than in Latitude-Longitude polar coordinates.

The ongoing development of the new DIS Version 8 standard is considering the use of Geodetic Coordinates instead of Geocentric. This would eliminate the coordinate conversion to and from Geocentric coordinates for the sake of dead reckoning. Many entities are static and require no dead reckoning at all. Dynamic terrain and cultural features are increasingly modeled as simulation entities, meaning many more static entities will be generated as fidelity requirements increase in the future.

For moving entities, it is possible to perform dead reckoning in Geodetic Coordinates. It requires some approximation but the error is insignificant. No matter how accurate the algorithm, dead reckoning itself is at best an estimate of the future behavior of an entity so a slight decrease in accuracy has no effect.

The use of the body axis dead reckoning algorithm is further explored. This has been defined in the DIS standards since 1995 but has seen little use and is generally not well understood. However, it has been found to give a significantly better result for predicting the path of turning vehicles. This algorithm has been adapted to Geodetic Coordinates and tested.

This paper describes algorithms for performing dead reckoning in Geodetic Coordinates. The difference in accuracy between the Geodetic and the traditional Geocentric dead reckoning is analyzed and compared. The body axis dead reckoning algorithm has been found to give the same superior results in Geodetic Coordinates as it does in Geocentric. It is the basis of the Geodetic dead reckoning that is being proposed for DIS Version 8.

Simplification of dead reckoning algorithms is also being proposed. This is related but independent of the decision to use GDC coordinates. The first phase of research toward a single dead reckoning algorithm for moving entities is described.

18W- SIW-030

CLOUD-BASED MODELING AND SIMULATION

This paper is being presented: Wednesday, Salon 3, 1030-1100, SVCS Track

Primary Author: COL. Robert Kewley, PhD

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Abstract: This paper describes initial efforts of the Cloud-Based Modeling and Simulation Study Group, whose purpose is to create a reference architecture, a service description template, and Distributed Simulation Engineering and Execution Process (DSEEP) Modeling and Simulation as a Service (MSaaS) Overlay. The effort is divided into four theme subgroups:

- Services
- Models and Data
- Cloud Technologies
- Architecture

The Services theme builds from the work of the NATO Modeling and Simulation Group (MSG-136) subgroup. The objectives are to investigate, propose and evaluate standards, agreements, architectures, implementations, and cost-benefit analysis of Modeling and Simulation (M&S) as a Service (MSaaS) approaches. Specifically, with regards to evaluating the use of M&S domain services to improve simulation interoperability and credibility, and to analyze organizational M&S services.

The Models and Data theme explores these topics in the context of modern cloud computing and Big Data environments. Traditionally, these topics have only considered structured data, techniques in traditional text-based schema specifications and data model descriptions. Of particular interest is how unstructured and structured data can be simultaneously employed, as opposed to structured data. Another key issue is that of dynamic data schema which enables previously unknown systems to be dynamically employed.

The Cloud Technologies theme builds on a study and set of presentations conducted by the Defense Modeling and Simulation Coordination Office (DMSCO). The goal is to understand the impact of cloud computing technologies on modeling and simulation from a number of different perspectives such as system scalability, advanced visualization, scalability of data systems and high-throughput low latency connections to compute and memory, and ease of integration into the internet of things type scenarios (which are strikingly similar to embedding M&S into live military hardware).

The Architecture theme group aspires to synthesize concepts and constructs from the current M&S architectures into a coherent vision for the future optimized for modern cloud computing and Big Data environments. One of the goals is to enable interoperability with legacy architectures while providing an unconstrained path to the future. One of the key shortcomings of previous architectures was the inability to explicitly enable reuse at a level of granularity finer than that of a monolithic computer program – meaning the ability to reuse individual algorithms or libraries. This would lower the barrier to entry for creativity and provide a better business model that would organically enable innovation to be incorporated into larger systems and programs of record.

This paper will describe the knowledge base from which the effort will begin and several of the important ideas that animate each of the themes. In this way, the inherent complexity of the endeavor is decomposed into manageable pieces that have distinct relationships to the others

and provide a context in which to understand the overall project. This initial attempt at unifying a number of different viewpoints in each of the theme areas provides a new form for community engagement and opportunity to contribute to the understanding and employment of an important new technology for the M&S community.

18W- SIW-031

A NEW ARMY MODELING FRAMEWORK

This paper is being presented: Wednesday, Salon 3, 1100-1130, SVCS Track

Primary Author: Charles Sanders, PhD

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Abstract: Background: The Army M&S Enterprise requires new M&S capabilities to meet future warfighting requirements and accurately represent complex and dynamic environments and threats. Some of the new required capabilities are due to changes in information technologies, such as migration to cloud computing and M&S as a Service. Also, the M&S Enterprise is challenged by the reality that M&S technology is changing and opportunities are emerging faster than the current paradigm can respond. By the time requirements analysis, detailed design, acquisition approval, development and testing is complete, requirements have dramatically changed and new technologies have emerged. Thus, new capabilities are already obsolete before delivery to the warfighter.

Modifying or updating legacy M&S tools is not sufficient to meeting emerging requirements, as they are inherently man-power intensive and costly to upgrade and sustain. Current design sustains stovepipes between the different M&S communities and does not support natural interoperability or sharing of M&S resources. Therefore, a new approach is required to develop the required capabilities more rapidly and with much less post-development integration reengineering.

Opportunity: New modeling approaches are emerging that offer an opportunity to better leverage new technologies and tools, and create inherently interoperable capabilities faster through cooperative and coordinated R&D efforts. Open source software development promises to enable crowd sourcing, proven to be much more effective for innovations. This also opens participation by smaller companies with new ideas. Lastly, cloud computing and M&S as a Service architectures promise to better enable cooperative and distributed development efforts.

Concept: The key to developing future M&S capabilities will be a common modeling framework, below the federate level, in which newly developed technologies and tools from industry, academia, and DoD labs can be integrated and tested; and then retained in a persistent distributed modeling environment. This means a new sharable synthetic environment can be gradually developed, piece by piece upon an established common technical foundation. The advantage of this new approach is that this new synthetic environment will provide needed capabilities faster as each tool and or software is developed and tested by scientists and developers; then validated by military operators. This new modeling framework will also enable sharing of investments and facilitate reuse.

Recommended COA: Creation of an Army modeling framework will require cooperation and participation of Army labs across the different R&D (DoD, industry, and academic) communities. A careful and inclusive dialogue will establish the best foundation for the simulation test bed. The following actions additional recommended are:

1. Gather scientists and M&S developers across the R&D M&S (DoD, industry, and academic) community to develop a conceptual design of the simulation test bed required to support the cooperative development and testing efforts.
2. Explore new modeling approaches and evaluate their potential for the Army modeling framework.
3. Conduct testing events to compare compatibility of the new modeling approaches.
4. Explore candidate Army, DoD, industry, and academia labs to host the simulation test bed, to include a virtual distributed web or cloud accessible solution.

18W- SIW-032**BALANCING TECHNOLOGY WITH CYBERSECURITY FOR MODELING AND SIMULATION IN THE CLOUD**

This paper is being presented: Tuesday, Salon 3, 1400-1430, SVCS Track

Primary Author: Matthew Rodriguez

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Abstract: This paper is a review of the efforts across the Modeling and Simulation (M&S) community as it seeks to develop standards to help expedite learning and potential application for conducting M&S in the cloud. M&S in the cloud is the next step in developing future application.

18W- SIW-033**ENABLING THE FUTURE OF SIMULATION W/ DATA CENTER TECHNOLOGIES & HYBRID CLOUD**

This paper is being presented: Tuesday, Salon 3, 1330-1400, SVCS Track

Primary Author: Chuck Louisell, PhD

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Abstract: In the future, data center and hybrid cloud technologies will transform the delivery of simulation from a fixed infrastructure, localized model to a fluid infrastructure, distributed model. This transition will enable users to consume simulation as a service – a necessary step in the journey toward the full-scale Live-Virtual-Constructive (LVC) objective. Primary change mechanisms are open architectures, software modularity, software defined networking, and a data center-hybrid cloud delivery model. In the objective state, specific weapons system core modules interface with common modules such as terrain, weather, threat, munitions, and countermeasures to generate the mission environment and entity interactions necessary to support distributed simulation sessions. In simulation-as-a-service, training scenario workflows are generated centrally to satisfy individual and collective training demands. They are provisioned globally via a data center and hybrid cloud architecture that enables real-time, dynamic workload assignment across distributed computing resources.

The objective of this paper is to survey current technologies and practices that could be core to simulation-as-a service and assess their applicability and transferability from the commercial environment into the mission-training environment. Lessons learned in data center and hybrid cloud technologies in commercial solutions, in network architectures used in unmanned aerial systems, and in embedded computational capabilities used in distributed intelligence are summarized. The paper is intended

to relate transferrable advancements in the commercial and defense sectors to functional requirements that will drive standards compliant solutions to progressively realize simulation-as-a-service.

18W- SIW-034**FUTURE IMPROVEMENTS TO COMBAT AIRCRAFT SIMULATION TRAINING: MTDS AS MEANS FOR MORE REALISM**

This paper is being presented: Tuesday, Salon 2, 1530-1600, SLT Track

Primary Author: Sönke Pink, PhD

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Abstract: NATO and nations face challenges regarding live training and exercises. Current and future operations are multinational in nature, the missions and the systems are becoming more complex and need detailed preparation and rapid adaptation to changing circumstances is needed. At the same time opportunities for live training and mission preparation are reduced due to less available resources, more peacetime restrictions and limited time span between political decision making and deployment. Mission Training through Distributed Simulation (MTDS) presents a solution to these challenges and is therefore crucial to NATO and nations' mission readiness. Despite a number of initiatives in the past to set-up a NATO MTDS capability, currently NATO does not have a standing operational MTDS capability.

In October, 2013 the NATO task group MSG-128 was set up with the objective to establish essential elements for a permanent NATO MTDS capability for air operations and validate these elements through initial operational exercises and evaluation.

The MSG-128 concluded its technical work with a 4th exercise in March 2017. This exercise proved that realistic combined mission training for fighter pilots and controllers can be achieved in the initial NATO MTDS capability. The exercise also showed that there are still technical challenges that should be addressed in future research activities.

This paper explains the work done during the NATO Modelling and Simulation Group (NMSG) 128. The focus of explanations will be put on the network infrastructure via the Combined Force Battle Lab Network (CFBL Net) and the two most important training areas Communication and Electronic Warfare. The paper will finish with an overall evaluation of the performed work, the technical lessons learnt and an outlook for the near future.

18W- SIW-035**A NEW PARADIGM FOR ENVIRONMENTAL DATA GENERATION AND MANAGEMENT**

This paper is being presented: Monday, Salon 3, 1630-1700, SVCS Track

Primary Author: Daniel Maxwell, PhD

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Abstract: Historically, the challenge for simulation developers in generating environmental data for simulations was creating a virtual world rich enough to engage the using audience. Data was hard to find, causing developers to create data that was realistic looking, but not necessarily accurate. This limited the simulation community's ability to interoperate with other systems in the infosphere (e.g. C2 systems, Intelligence Systems). Those historical limitations are long gone and there is a seemingly insatiable demand for accurate and interoperable information systems, including high resolution simulation. Meeting these demands will require new ways to think about the generation,

management, and distribution of environmental data.

This paper proposes a new paradigm for organizing the discourse about environmental data generation and management. Thanks to geospatial community efforts, we now have maturing geospatial data standards that can be leveraged to improve interoperability among simulations and between simulations and other information systems. Cloud technologies enable transmission of standards-based data, allowing streamlined communications of increasing amounts of high-resolution, geospatial data. In this paper, we lay out a strategy for simulation professionals to use these modern standards and cloud technologies to obtain and share the high-resolution, accurate data they require. We will discuss lessons learned through a prototype developed as part of a research effort, including interoperability lessons already learned in the simulation community that will benefit other information system developers. Finally, we will lay out the next steps towards achieving the vision of broad infosphere community interoperability through streamlined, point-of-need environmental data services.

18W- SIW-037

TOWARDS A STANDARDIZED FEDERATE PROTOCOL FOR HLA 4

This paper is being presented: Wednesday, Salon 3, 1600-1630, SVCS Track

Primary Author: Björn Möller

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Abstract: HLA is a powerful interoperability standard with a rich set of services for information exchange, synchronization and management of federations. These services are accessed through a local RTI library, installed on the same computer as the simulation itself. As new and improved RTI versions are released, or if the user want switch RTI supplier, these libraries need to be replaced. What if there were instead a simple protocol, that a simulation could use to access the HLA services? This paper proposes such a protocol for HLA 4. It partly builds on experiences from the Web Services API in HLA Evolved. The WS API proves the concept, but has several shortcomings due to its use of blocking calls and of XML. An optimized, streaming, binary protocol is instead suggested. Such a protocol would make it easy to add a small and generic library to any federate. Switching RTI libraries would then be a simple operation of connecting to a different network address.

Additional advantages are that it makes it easy to provide native HLA support for any language, like C# or Python, to execute in CPU-constrained or hard real-time environments, to communicate in mobile environments, like 3G or 4G, or even to embed HLA support in hardware equipment. It can also be used to avoid re-accreditation of simulations, since the accredited simulator need not be updated.

Some design considerations include discovery, session management and latency handling.

Early test implementations have shown performance close to current RTI performance and improved fault tolerance over WAN links. To be able to easily swap between different RTI implementations, a standardized protocol is now being proposed to the HLA 4 Product Development Group.

2018 Winter 'SIWzie' Awarded paper

18W- SIW-038

DESIGN AND PRINCIPLES ENABLING THE SPACE REFERENCE FOM

This paper is being presented: Tuesday, Salon 2, 0900-0930, Best Paper Forum

Primary Author: Björn Möller

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Abstract: A first complete draft of the Simulation Interoperability Standards Organization (SISO) Space Reference Federation Object Model (FOM) has now been produced. This paper provides some insights into its capabilities and discusses the opportunity for reuse in other domains.

18W- SIW-040

IMPROVING TACTICAL DATA LINK SIMULATION STANDARDS TO BETTER SUPPORT LVC EXERCISES.

This paper is being presented: Tuesday, Salon 2, 1330-1400, SLT Track

Primary Author: Jouni Lindqvist

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Abstract: A few years ago, the Swedish Air Combat Simulation Center, the FLSC, updated its simulation systems to be based on HLA Evolved. In addition to increasing the robustness and performance of the simulation system, the aim with the upgrade was to simplify the cooperation with external organizations inside and outside of Sweden and Europe and significantly reduce the time and effort required to add new functionality.

The FLSC has also taken an initiative called the Air Combat FOM, which extends the RPR standard reference FOM to better support aerial combat simulation and further enhance the level of interoperability between various internal and external simulation components. As part of the work of extending the RPR-FOM, FLSC has also identified a need to improve the way current standards support simulations of Tactical Data Links or TDL.

The identified drawbacks with the current standards of simulating the Link16 TDL is that it requires a lot of effort to implement and is hard to use when connecting to simulation sites in other security domains. The current standards have not succeeded in attracting the COTS market in supporting it and today, as an example, very few COTS CGF tools support TDL. Benefits of the current standards are however that they enable the connection with real/live systems and since LVC is an important requirement for the future of FLSC this has to be catered for in future version of TDL simulation standards.

Another requirement, due to the need to simulate and support training for other countries than Sweden, the TDL simulation standard should support the simulation of different TDLs without the requirement of making large changes to the simulation system. A more generic and "clear text" implementation that complements the current standards requirement for a link specific binary data array.

This paper discuss how current standards should be updated to better support the simulation requirements of the FLSC and similar sites and improve interoperability with other simulation sites while maintaining interoperability with real Tactical Data Link networks.

18W- SIW-043 - Invited Presentation**LATEST ADVANCEMENTS IN EMBR: A GOTS M&S MANAGEMENT TOOL FOR COLLABORATION AND REUSE**

This invited presentation is being presented: Tuesday, Salon 3, 1600-1630, SVCS Track

Primary Author: Rachael Orzechowski

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Abstract: Over the last 3 years, the Department of Defense M&S Coordination Office (DMSCO) has sponsored research and development of tools, standards, and policies to foster improved discovery, collaboration, and reuse of M&S resources. The development and deployment of the Enterprise Metacard Builder Resource (EMBR) Portal, a GOTS tool based on DoD-approved metadata standards, provides M&S practitioners and senior decision-makers with greater insight into their M&S assets and new opportunities for knowledge sharing and collaboration.

EMBR is a low cost, technologically advanced, software tool with a modular, rapidly configurable architecture that is completely GOTS. But, the research team has learned that effective M&S management involves more than technology. Lessons learned from current operational deployments of EMBR suggest that organizations which fully incorporate the tool into their planning and coordination produce greater insight and realize greater cost savings than those that do not. A case study of PEO IWS M&S Engineering Working Group is discussed in the paper.

Finally, the research team has developed a novel business model that is highly favorable to the government. Although multiple organizations fund specific EMBR capabilities, each contributing organization realizes the benefit of every capability developed. This development approach maximizes the features of EMBR while ensuring the tool retains its GOTS status. This approach has implications for other technology projects funded by multiple organizations across government, industry, and academia.

18W- SIW-045**AUTOMATING HUMAN FACTOR CONSIDERATIONS FOR ACQUISITION DECISION MAKING**

This paper is being presented: Tuesday, Salon 2, 1400-1430, SLT Track

Primary Author: O. Thomas Holland, PhD

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Abstract: The Marine Corps Systems Command serves as the Navy's systems command for Marine Corps ground weapon and information technology system programs. To equip and sustain Marine forces with full-spectrum expeditionary and crisis-response capabilities requires the ability to rapidly assess and develop material solutions in light of anticipated and emergent requirements. This ability is even more critical as the technologies becoming available to our adversaries increase the complexity of the Marine mission space while reducing the time available to determine and acquire the needed capabilities. To address this need for rapid acquisition decision-making, the Marine Corps has developed the Framework for Assessing Cost and Technology (FACT), a computational environment that enables the rapid exploration of the design tradespace for systems engineering analysis through the concurrent exercise of disparate domain models. Knowing that the earlier human factor issues and risks can be addressed in a system's design, in this paper we present how FACT, through an

Office of Naval Research (ONR) Small Business Innovative Research (SBIR) Program, is extending the tradespace it considers beyond the domains of performance, reliability, and cost to include considerations for the domain of human systems integration (HSI).

18W- SIW-047**AN ONTOLOGY-DRIVEN FRAMEWORK FOR ENABLING ADAPTIVE TRAINING APPLICATION INTEGRATION**

This paper is being presented: Wednesday, Salon 2, 0930-1000, SLT Track

Primary Author: Perakath Benjamin, PhD

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Abstract: Adaptive Training is intelligently tailored, computer-guided experiences for individuals and units focused on optimizing training performance, training efficiency, deep learning, and transfer of skills to the operational environment. Training "adaptation" is multi-faceted. For the trainee, the delivery of training must adapt to individual trainee needs and to the organizational groupings of trainees (e.g., an Army unit). Training must be adaptively tailored to trainee state (cognitive, affective, psychomotor, social, etc.) and to trainee task performance. Adaptations might be determined and delivered in real time during training events or determined through assessment of learner data over extended time and delivered periodically (non-real time). Adaptations may seek to inform and optimize instructional strategies both during training and off-line (between training sessions). Training content adaptations might be automated, semi-automated, or human (instructor)-driven. From a "training systems" life cycle perspective, the adaptation approaches must seek to optimize training over learner lifecycles through optimal blending of training types and modalities (e.g., computer-based, tutor-based, game-based, simulation-based, Live, Virtual, Constructive (LVC), etc.).

A central barrier that impedes increased use of adaptive training is the high time and cost required to build and maintain these complex training applications. This research provides an ontology-driven approach to address the hard and unsolved technical barriers associated with semantic application integration. This paper describes an ontology-driven Framework for Enabling Adaptive Training that targets this challenge. The paper will describe: (i) an ontology-driven method for semantic integration to enable multi-domain adaptive training; (ii) an architecture for providing automation support for the method; (iii) an approach to extend and enhance the Generalized Intelligent Framework for Tutoring (GIFT) using the semantic integration method; and (iv) multi-domain adaptive training application integration examples that show the practical benefits of the solution approach.

18W- SIW-048

LESSONS LEARNED FROM IMPLEMENTING A COMMON IMAGE GENERATOR INTERFACE (CIGI) V4.0 COTS BASED IMAGE GENERATOR (IG) FOR DRIVER TRAINING

This paper is being presented: Monday, Salon 3, 1600-1630, SVCS Track

Primary Author: Roland Humphries

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Abstract: The use of open standards and COTS products has long been believed to provide improvements in quality and value for money for the customer, as they support better interchange / reuse of existing data and the COTS tools have usually benefited from larger development budgets. Based on this XPI began the process of developing a next generation IG solution largely based on open-source, standards and COTS tools. The IG is based on a commercially available games engine, communication is via CIGI V4.0 and assets are modelled in a variety of COTS tools before being stored in FBX, TGA and DDS formats. During development of this solution a number of important lessons have been learned that apply to asset pipeline and high-performance rendering solutions in general. This paper provides some details of the solution, the asset pipeline (also using COTS tools) to support easy use of both articulated and animated models with minimal coupling, and some of the solutions created by XPI to work around the deficiencies of both CIGI and some features that are not commonly considered with games engines solutions (e.g. large area terrain, simple simulation time synchronization, viewport management, network rendering). The paper will also go into some detail on optimal CIGI host practices to minimize bandwidth and IG command processing load. Finally, some recommendations are given on changes that should be made to CIGI to better support land simulations with high entity counts.

18W- SIW-050

AUGMENTED REALITY TOOL FOR DEPOT-LEVEL VISUALIZATION, LOGGING, AND TRACKING

This paper is being presented: Wednesday, North 2, 0830-0900, SPEC Track

Primary Author: Timothy Rodabaugh

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Abstract: Over the past decades, the nondestructive evaluation (NDE) techniques used by the U.S. Air Force to maintain the fleet have continuously advanced. However, the tools and methods by which these inspections are conducted can have added capabilities by improving inspection documentation and insuring inspections are done correctly. Recent maturation of wearable augmented reality (AR) technology presents significant opportunities to modernize the interaction between the inspector and the inspection documentation, data, and hardware. In this work, an augmented reality application was developed to demonstrate potential enhancements of NDE inspection methods including: (i) Display of inspection data on a holographic interface, and (ii) spatial registration and positional capture of hand held devices during an inspection. Initial testing and documentation of the AR device identified research challenges dealing with restricted Wi-Fi connectivity and low application development capabilities to adapt this technology to NDE applications in the U.S. Air Force. OpenCV

object recognition was applied to track a hand held inspection probe's position and localize this spatial information to the inspection location on the aircraft. Representative eddy current inspection data, digital technical order documents, and onsite job aids demonstrate how an AR holographic interface could impact eddy current inspection practices. This effort illustrates the promise of AR technology. Additional research opportunities exist due to its market accessibility, app building capabilities, and relatively low costs for additional development. Transitioning this technology could improve the tools and process used to accomplish aircraft-based NDE assessments. Additional research is being performed to explore how this capability can be used for Depot-based inspections.

18W- SIW-051 – Invited Presentation

CYBER WARFARE FOR TRAINING RESEARCH (CYWAR-T)

This invited presentation is being presented: Tuesday, North 2, 1630-1700, SPEC Track

Primary Author: Henry Marshall

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Abstract: This presentation discusses on-going «Cyber for Training» related research at ARL Orlando. After talking with numerous stakeholders, we decided to develop a prototype system for training audiences to experience cyber-attacks on their tactical mission command systems and to make recovery decisions. This prototype, called Cyber Operations Battlefield Web service (COBWebS), provides the capability to simulate the effects of various cyber-attacks on command and control communication between the synthetic entities and the Blue Forces mission command systems. Our prototype leverages the OneSAF Mission Command Adapter Web Service (MCA-WS) and adds cyber warfare effects modeling. We will share our experience developing and field testing this cyber warfare training capability. This system is part of OneSAF 8.7 and is being considered for JLCCTC. In addition, we will discuss another effort that is just starting called the Cyber Battlefield Operating Systems Simulation Tools for LVC Simulations (CyberBOSS). This research looks at the development of a cyber server to manage cyber events between Live training and simulations.

18W-SIW-052

SUPPLEMENTAL ELECTROMAGNETIC DATA IN DIS AND ITS ASSOCIATED PERFORMANCE

This invited presentation is being presented: Wednesday, Salon 3, 0930-1000, SVCS Track

Primary Author: Cord Cardinal

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Abstract: DIS is designed to provide a means of synchronizing simulation states across multiple platforms. In most cases it provides sufficient fidelity to achieve this goal. However, for electromagnetic generating simulations (such as RADAR, jammers, etc) there is a very wide range of detail required depending on the goal of the particular simulation. In some cases, it may be sufficient to only pass basic emitter parametric data, or to provide periodic notification that a radar beam from Simulation A has swept by or is tracking a platform owned by Simulation B. However, in many other cases, this is not nearly enough information to provide high-fidelity training to our CAF aircrew. For example, one very consistent limitation we've seen across a wide range of FMT/WST systems is a lack of accurate audio generation from the

radar warning receiver (RWR). There is simply not enough information in the existing DIS EE PDU for the host to consume that will result in accurate RWR audio. Also, for ESM signal recognition, the timing of the beam and individual pulses will make the difference between an acceptable simulation and negative training.

Expendable models, jamming simulations, multi-function radars, ECCM, and RWR simulation all require precision timing to ensure the results of simulated electromagnetic activity is perceived in the same way between attacker, defender and observer. Furthermore, missions may not be replayed correctly if the events themselves do not provide sufficient data.

In DIS the Electromagnetic Emission PDU (EE PDU) provides most of the required information to simulate the state and, to some extent, the definition of emitters. Where this information is insufficient the system relies on a local emitter database to 'regenerate' an emitter. However, there are several problems with this approach:

1. Emitter definitions: Every simulation must keep its emitter data coordinated with every other sim.
2. AESA/PESA radars may define scan, pulse, or beam shape based on an algorithm during execution.
3. Host simulators often require much more information than what is available in the EE PDU, and even if the data is present in the offline CEPD, there is no standard for communicating this information to the host.

In order to alleviate these problems, a number of supplemental DIS Data PDU messages are suggested. Note that these messages are independent of each other but provide increasing levels of fidelity and logistical independence for electromagnetic generating simulations.

18W-SIW-053 - Invited Presentation

THE NATIONAL ENVIRONMENTAL SIMULATION AND TESTING FACILITY (NEST)

This invited presentation is being presented: Wednesday, Legacy North 2, 1130-1200, SPEC Track

Primary Author: Robert C. Huck, PhD

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Abstract: The infrastructure of the United States is composed of more than \$4T in weather susceptible components. The ability to create physics based weather phenomena to test the susceptibility of these components is limited in most cases to a single phenomenon and on a small scale. Our project, the National Environmental Simulation and Testing (NEST) facility is to develop a capability where equipment manufacturers can bring their equipment for full-scale, multi-phenomena, repeatable, and replicable environmental testing. A collocated feature of the NEST will be a Computational Collaboratory which will utilize sophisticated computer models to simulate and calibrate against, and extend the capabilities of physical experiments in the NEST. In addition to product testing, our facility will support the State of Oklahoma, the region, and the mission of University of Oklahoma by providing economic development, furthering our leadership in Weather and Radar development, and an education and research capability. The size of the facility creates a space where multiple tests with multiple weather phenomena can be accomplished simultaneously. The range of industries being targeted for testing include aviation, power grid, packaging, transportation, construction, crop resilience, fire dynamics, and communications. Rain, wind, hail, diurnal cycles, extreme temperature, altitude, high pressure, anechoic,

acoustic, structural, and vibration testing capabilities will be included. The size of the facility will provide the flexibility and reconfigurability to perform testing today, tomorrow, and for the next 50 years.

18W-SIW-054 – Invited Presentation

THE FUTURE OF STANDARDS IN EVER-CHANGING SIMULATION ENVIRONMENTS

This invited presentation is being presented: Wednesday, Salon 2, 1030-1100, SLT Track

Primary Author: Tim Cooley, PhD

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Abstract: In today's complex simulation environments standards are essential to large scale success. However, simulation and training environments and tools are rapidly changing. Whether the technology is new, or a new adaptation of old methods, the standards needed and the way we view standards may have to change. How will standards change and what is the best approach to ensuring standards are considered at the inception of the upcoming enhanced environments? This presentation will focus on some of the new simulation and training enhancements, the standards that need to remain, and some ideas for new standards that may need to be developed.



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