

### STE-MN – An Architectural Approach for Future Multinational Simulation Interoperability

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### Introduction

- This work investigates and suggests practical approaches to fuse existing and emerging North Atlantic Treaty Organization (NATO) Modelling and Simulation Group (NMSG) standards with the US Army simultaneously developing the Synthetic Training Environment (STE) to modernize simulation and training platforms.
- NSMGs and STE may be integrated using the Live Virtual Constructive-Integrating Architecture (LVC-IA) and its tools as interim capabilities.





# Rationale

- STE "must interoperate with the LVC-IA to facilitate bridging with current training systems." (STE Statement of Need)
- LVC-IA offers a low-risk, low-overhead, and flexible collection of tools and frameworks necessary to merge complex, evolving, and bleeding edge technologies into STE-Multinational (STE-MN).







# Background - NMSGs

- NMSG standards cover
  - Methodologies
  - Architectures
  - Processes
  - Interoperability

- Data Models
- Synthetic Natural Environment
- Networks
- NMSG standards approach attempts to modernize existing capabilities, inspired by the emergence of the cloud, web services, and micro-services, by unifying approaches using industry and commercial standards.
  - NMSG standards use SEDRIS, MSDL, C-BML, etc.





# Background - STE

- STE will provide a cognitive, collective, multi-echelon training and mission rehearsal capability for the operational, institutional and self-development training domains.
- The emerging capability is anticipated to include technological features:
  - One World Terrain (OWT)
  - Training Simulation Software (TSS)
  - Training Management Tools (TMT)







# Background – STE (continued)

- STE is anticipated to replace current modern and legacy US Army virtual and constructive training simulators in order to better augment live training and deliver training capabilities to the Point of Need (PoN).
- STE focuses on reusing commercial standards rather than industry standards.
- STE is working to blend simulations to allow for the eventual inclusion of Joint and multi-national partners.
  - The multi-national capability must enable training and fighting with allies, simplify interoperability with an open architecture, and must speed up the planning and configuration processes.





# Background – LVC-IA

- LVC-IA has an open architecture with an extensive set of enterprise web tools such as ExCON, AAR, and gateways/data translation services that accelerate the time to configure, provision, connect, run, and review LVC exercises.
- STE has already identified LVC-IA as the bridge to legacy systems.



LVC-IA may help to integrate STE with NMSGs now. This gives time to mature STE and develop multi-national capabilities that will eventually blend international standards into a future LVC STE capability.





## Approach

- There are many unknown approaches for STE, but there LVC-IA is postured well to integrate with NMSGs, and that may help the STE multinational effort.
- First, integrate with the NMSG standards and capabilities through LVC-IA in the interim to reduce risk to the emerging concepts of STE.
- Then, the NMSG standards and approaches may be evaluated for inclusion into STE proper to transition from LVC-IA.

#### Current known state of standards

| Capability                                      | STE  | LVC-IA  | NMSG  |
|---|--|---|---|
| M&S Methodolog<br>Architecture and<br>Processes | y,<br>I Unknown                                      | DoDAF<br>COEv3<br>MBSE                                      | NAF<br>C3I Systems  |
| *Conceptual Model<br>and Scenarios              | ling Unknown   | Some MSDL   | MSDL<br>BOM<br>GSD  |
| *M&S Interoperabi                               | Presumed ESB<br>lity Compatible DIS<br>Enum, RPR FOM | DIS v6 and v7<br>HLA v1.3<br>ESB                            | HLA (STANAG 4603)   |
| *Information Excha<br>Data Model                | nge Unknown  | C-BML Capable   | C-BML   |
| Software Engineer                               | ng Unknown   | UML   | UML   |
| *Synthetic Natura<br>Environment                | al One World Terrain                                 | SE Core<br>SEDRIS<br>DTED<br>Open Flight<br>Collada<br>CIGI | SEDRIS<br>DTED<br>Open Flight<br>Collada<br>RIEDP<br>CIGI |
| Simulation Analys<br>and Evaluation             | is Unknown   | Program Specific  | DDCA  |
| M&S Misc.                                       | Unknown  | Repeatable RMF<br>Accreditation Process                     | Unknown   |







# Solution

- **Conceptual Modelling and Scenarios** interoperate through enhanced MSDL via enterprise scenario generation tools.
- M&S Interoperability via Joint BUS (JBUS) data gateway which may be extended to support HLA STANAG 4603, already supports DIS, and provides an Enterprise Service Bus (ESB) for a Modular Open Systems Architectures (MOSAs).
- Information Exchange Data Model partially provided by JBUS in conjunction with M&S interoperability. Also provided by a tactical communications service which partially support C-BML, this would need to be extended.
- Synthetic Natural Environment existing parallels between LVC-IA and STE suffice in the near term until OWT specifications are published.





### Process

#### 1. Crawl – Interoperate Current/Legacy Multi-National LVC Simulators

- Interoperate pre-exercise between multi-national capabilities using MSDL and C-BML. Gather lessons learned on adopting standards.
- Develop a JBUS HLA STANAG 4603 Plugin to interoperate between multi-national sims. JBUS is available to US organizations by obtaining an approved Distribution Agreement.

#### 2. Walk – Interoperate Multi-National Simulators LVC Using MSaaS

- Experiment with MSDL and CBM-L to improve for wider adoption across LVC tools. Publish findings and work to improve standards.
- Demonstrate multi-national simulators using common services, adopting to MSG standards and MSaaS business models, with less JBUS interoperability. Services and business model selection need to fill STE capability gaps.

### 3. Run – Interoperate Combining NMSG Standards with STE

Combine the STE Common Synthetic Environment (CSE) with multi-national capabilities where both STE and MSG approaches inspire each other for interoperability and improvements. CSE is the unified simulation environment units and soldiers use for training which includes elements of the Mission Command Information Systems (MCIS), TSS, TMT, and OWT.

### Stretch Goal – demonstrate in relevant LVC environments





# Next Steps

- Encourage the overall multi-national community to take the next steps to link up the international standards of the future being developed in the NMSGs with the futuristic US Army STE Modelling and Simulation (M&S) platform.
- LVC-IA may act as an interim bridge between the two because it is notionally compatible with both approaches already.
  - The LVC-IA architecture and its tools allows legacy simulators to simultaneously participate in modernization activities at different paces with incremental steps.
- Once the STE platform matures, it is anticipated that other US Services will adopt either the same or similar technologies to build their versions of STE.
- Being disruptive to the STE and NMSG timelines now will minimize disruption later when integrating.





# Conclusion

- The LVC-IA architecture allows legacy simulators to simultaneously participate in modernization activities at different paces with incremental steps.
  - LVC-IA offers a low-risk, low-overhead, and flexible collection of tools and frameworks necessary to merge complex, evolving, and bleeding edge technologies into STE-MN.
  - LVC-IA has an extensive set of enterprise web tools at the PoN and gateways/data translation services that will allow STE to set expectations for accelerated scenario development and reduced interoperability by leveraging automation.
- STE has already identified LVC-IA as the bridge to legacy systems; LVC-IA may also provide the bridge for phasing in modernized multinational interoperability.
- The STE-MN approach may benefit NATO and US communities integrating new capabilities while old capabilities are modernized, deprecated, or retired.
- Now is the time to make the two complex parallel STE and NMSG activities, "interoperable by design to connect people, technology, and nations," rather than an afterthought solved through cumbersome integration activities when it is too late and risky.



# Thank You



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