NORTH ATLANTIC TREATY ORGANIZATION

SCIENCE AND TECHNOLOGY ORGANIZATION

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STO MEETING PROCEEDINGS **MP-MSG-175**

Commercial Technologies and Games for Use in NATO and Nations

(Les technologies du commerce et les jeux à l'usage de l'OTAN et des Nations)

STO Modelling & Simulation Group (NMSG) 16th Workshop on Commercial Technologies and Games for Use in NATO and Nations held on 26 September 2019 in Paris, France.

Published October 2019

Distribution and Availability on Back Cover

The NATO Science and Technology Organization

Science & Technology (S&T) in the NATO context is defined as the selective and rigorous generation and application of state-of-the-art, validated knowledge for defence and security purposes. S&T activities embrace scientific research, technology development, transition, application and field-testing, experimentation and a range of related scientific activities that include systems engineering, operational research and analysis, synthesis, integration and validation of knowledge derived through the scientific method.

In NATO, S&T is addressed using different business models, namely a collaborative business model where NATO provides a forum where NATO Nations and partner Nations elect to use their national resources to define, conduct and promote cooperative research and information exchange, and secondly an in-house delivery business model where S&T activities are conducted in a NATO dedicated executive body, having its own personnel, capabilities and infrastructure.

The mission of the NATO Science & Technology Organization (STO) is to help position the Nations' and NATO's S&T investments as a strategic enabler of the knowledge and technology advantage for the defence and security posture of NATO Nations and partner Nations, by conducting and promoting S&T activities that augment and leverage the capabilities and programmes of the Alliance, of the NATO Nations and the partner Nations, in support of NATO's objectives, and contributing to NATO's ability to enable and influence security and defence related capability development and threat mitigation in NATO Nations and partner Nations, in accordance with NATO policies.

The total spectrum of this collaborative effort is addressed by six Technical Panels who manage a wide range of scientific research activities, a Group specialising in modelling and simulation, plus a Committee dedicated to supporting the information management needs of the organization.

- AVT Applied Vehicle Technology Panel
- HFM Human Factors and Medicine Panel
- IST Information Systems Technology Panel
- NMSG NATO Modelling and Simulation Group
- SAS System Analysis and Studies Panel
- SCI Systems Concepts and Integration Panel
- SET Sensors and Electronics Technology Panel

These Panels and Group are the power-house of the collaborative model and are made up of national representatives as well as recognised world-class scientists, engineers and information specialists. In addition to providing critical technical oversight, they also provide a communication link to military users and other NATO bodies.

The scientific and technological work is carried out by Technical Teams, created under one or more of these eight bodies, for specific research activities which have a defined duration. These research activities can take a variety of forms, including Task Groups, Workshops, Symposia, Specialists' Meetings, Lecture Series and Technical Courses.

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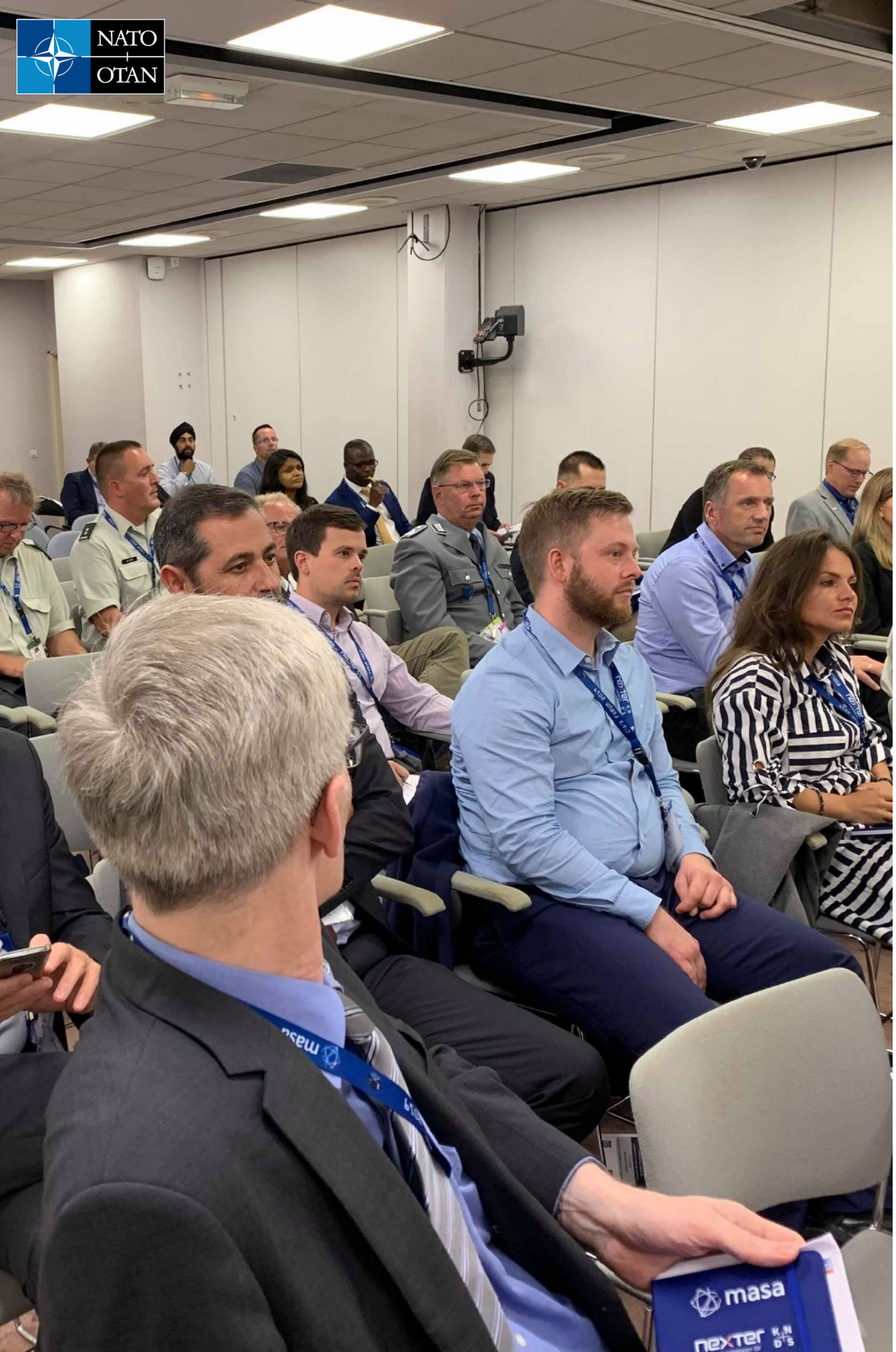
26 September 2019

Ecole Militaire, Paris (France)

NATO Modelling & Simulation Group (NMSG)

16th Workshop on Commercial Technologies and Games for Use in NATO and Nations



Introduction

The commercial sector is developing key technologies and applications that have the potential for cost-effective adaptation and use in modelling and simulation (M&S) applications for defence planning, training, operations and capabilities development. The exploitation of commercial technologies and appropriate use of open standards can provide efficiencies and increased benefits for defence applications.

It is, therefore, **vital for the NATO M&S community to identify those technologies that have the greatest near-term potential and understand the trends and developments in those technologies to meet current and future defence requirements**.

With the mission of keeping NATO at the forefront of technology development for theAlliance, the **NATO Modelling & Simulation Group organised a workshop on Commercial Technologies and Games for Use in NATO and Nations**, on the 26th of September 2019, in Paris, France.

Co-located with the CA2X2 Forum, the Workshop aimed at sharing national experiences, exploring commercial and games technologies, understanding best practices, and identifying barriers to further exploitation and ways these might be overcome.

The Workshop was open to participants from NATO and non-NATO nations.

Agenda of MSG-175 Workshop, 26 September 2019

8.30h-8.40h	Introduction Chairs: Wim HUISKAMP (TNO Defence Research, NLD) Niels KRARUP-HANSEN (DALO, DNK) LTC Wolfhard SCHMIDT (JFTC, DEU)
8.40h-9.10h	Keynote: Delivering Next Generation Simulation Today: Converging Virtual, Constructive and Gaming through Cloud Technologies Peter MORRISON (Bohemia Interactive Simulations, USA)

Session 1: Game Architectures and Game Engines
Chairman: Mr Wim HUISKAMP (TNO Defence Research, NLD)

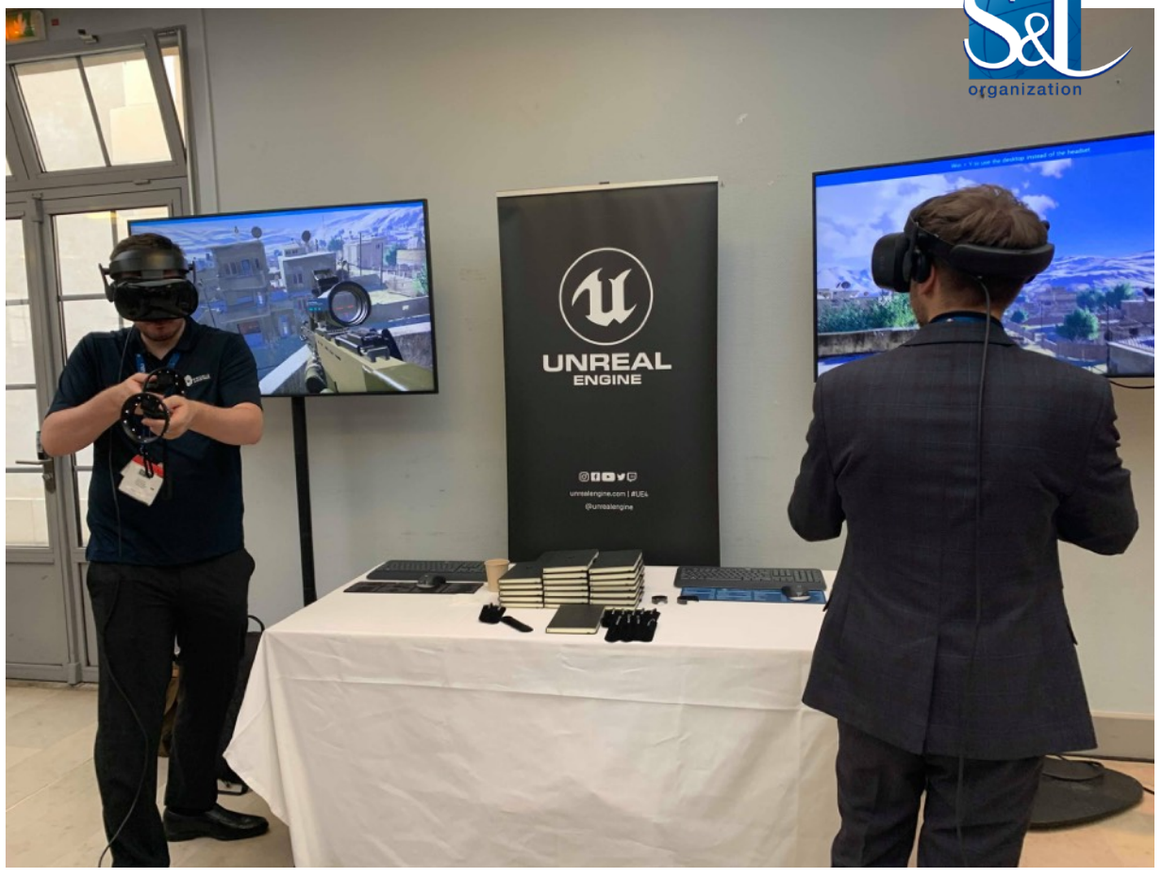
9.10h-9.35h	SpatialOS for Military Simulation and Training Karl BARKER, (Improbable, USA)
9.35h-10.00h	Scalable Dynamic Synthetic Environments using a Next-Generation Game Architecture Dr Ruben SMELIK (TNO Defence Research, NLD) Robbert KRIJNEN (TNO Defence Research, NLD)
10.00h–10.25h	Accelerate Training Digitization with Game Engines Sebastian LOZE (Epic Games, CAN)
10.30h-11.00h	***Coffee and Networking Break***

Session 2: Training Applications
Chairman: LTC Wolfhard SCHMIDT (JFTC, DEU)

11.00h–11.30h	Common Synthetic Training Environment for US Army Simulation Peter SWAN (VT MAK, USA)
11.30h-12.00h	Leveraging Cognitive Science and Virtual Reality to Meet Tomorrow's Training Challenges Col John M. FERRELL (US Army Aviation Center of Excellence, USA) Ms Jennifer LEWIS (SAIC, USA)
12.00h-12.30h	Discussion on Commercial Gaming Technology
12.30h-14.00h	***Lunch and Networking Break (at Ecole Militaire Cafetaria)***

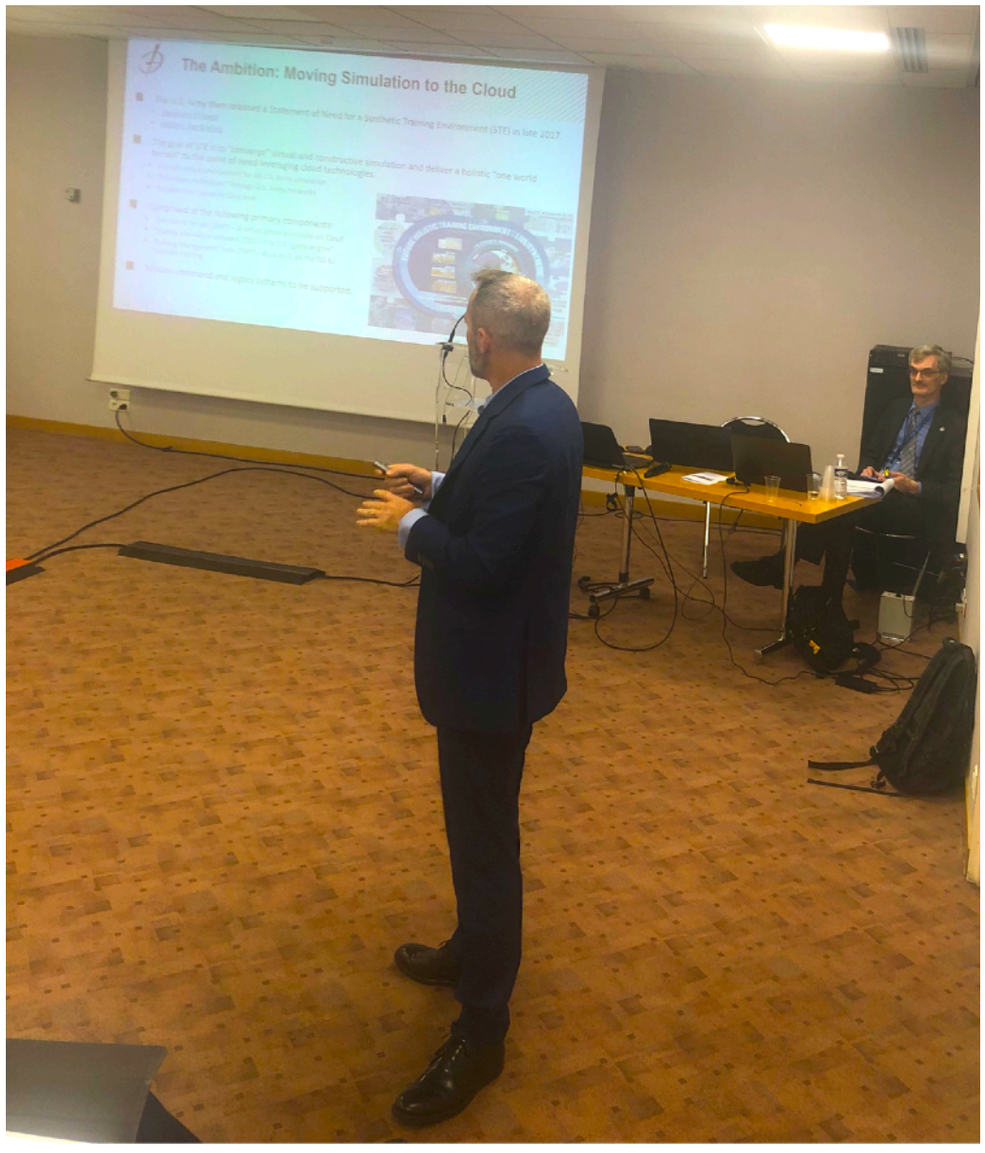
Session 3: Analysis, Design and Decision Support Applications
Chairman: Mr Niels KRARUP-HANSEN (DALO, DNK)

14.00h–14.25h	Via Robusta, Woe to the Strong: and HLA MS2G for Hybrid Warfare Prof Agostino BRUZZONE (Univ Genua, NATO M&S CoE, ITA), Col Paolo DI BELLA (Univ Genua, NATO M&S CoE, ITA)
14.25h–14.50h	Try-Buy-Adapt Amit KAPADIA (PEO-STRI, USA), Richard OSBORNE (The MITRE Corporation, USA)
14.50h-15.15h	Military Applications for Machine Learning Cpt Ugur UYSAL (Army Concepts and Capability Development Centre, DEU)
15.15h	Wrap-up. Conclusions and Way-ahead
15.30h-16.00h	***NATO CA2X2 FORUM 2019 PLENARY CLOSING SESSION***



8.40h-9.10h Keynote: *Delivering Next Generation Simulation Today: Converging Virtual, Constructive and Gaming through Cloud Technologies*

Peter MORRISON (Bohemia Interactive Simulations, USA)



Abstract: Western military organisations are striving to bring together virtual, constructive and gaming training environments into single unified architectures. Similar requirements are emerging in the United States (“Synthetic Training Environment”), the United Kingdom (“Collective Training Transformation Programme”) and Australia (“Land Simulation Core 2.0”). This paper examines the opportunities and challenges these requirements present to simulation developers and government defence organisations seeking to leverage game technologies in the cloud. Gaming technologies -- especially those that leverage the Cloud -- offer an unprecedented opportunity to scale simulation. For example, a cloud-enabled One World Terrain (OWT), a key requirement of the U.S. Army’s Synthetic Training Environment (STE) initiative, will enable warfighters to conduct virtual training and complex simulations anywhere on a virtual representation of the Earth. The U.S. Army’s STE will leverage cloud technologies to deliver training to the point of need, ensuring a common and high-fidelity whole-Earth terrain representation for a multitude of different simulation systems. This demanding requirement is beyond what most commercial video game engines provide out of the box, and this is just one example of the significant challenges that developers are working to address. This presentation will describe research and development efforts undertaken to accelerate simulation technology, including extensive use of industry-leading technologies from outside the military simulation domain. The presentation concludes with lessons learned related to the application of cutting-edge technologies to solving STE requirements.

Bio: Pete Morrison is BISim’s Chief Commercial Officer. Before BISim, Pete studied Computer Science and Management at the Australian Defence Force Academy and graduated with first class honours in 2001. He served as a Signals Corp Officer for several years, specialising in military simulation, and his final posting was to the Australian Defence Simulation Office (ADSO) as a Project Officer.

9.10h-9.35h

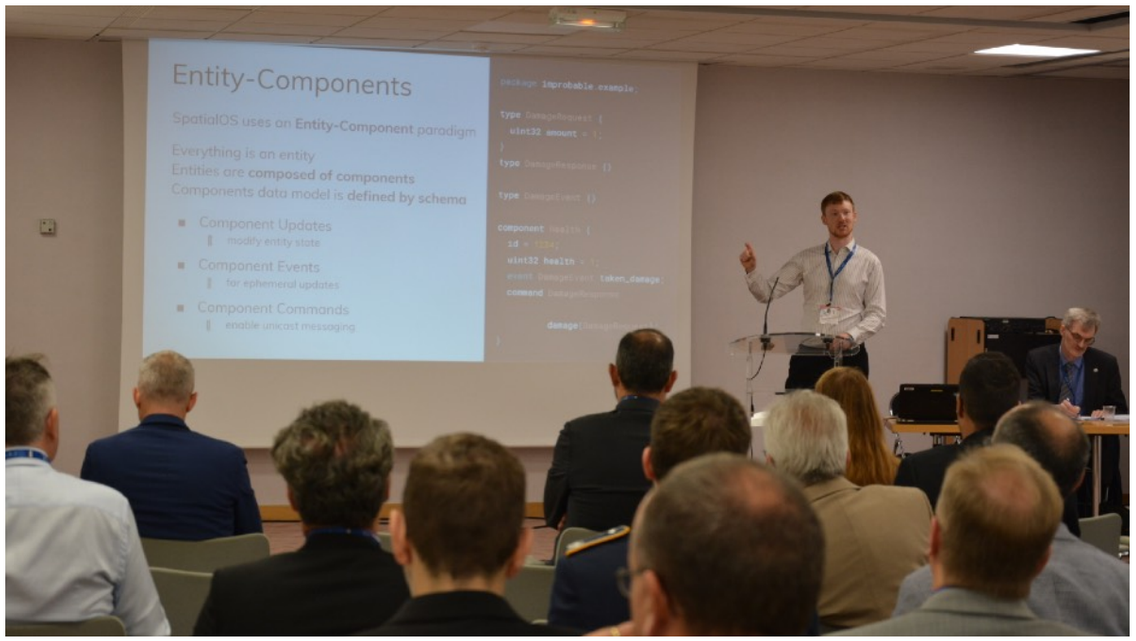
SpatialOS for Military Simulation and Training

Karl BARKER (Improbable, GBR)

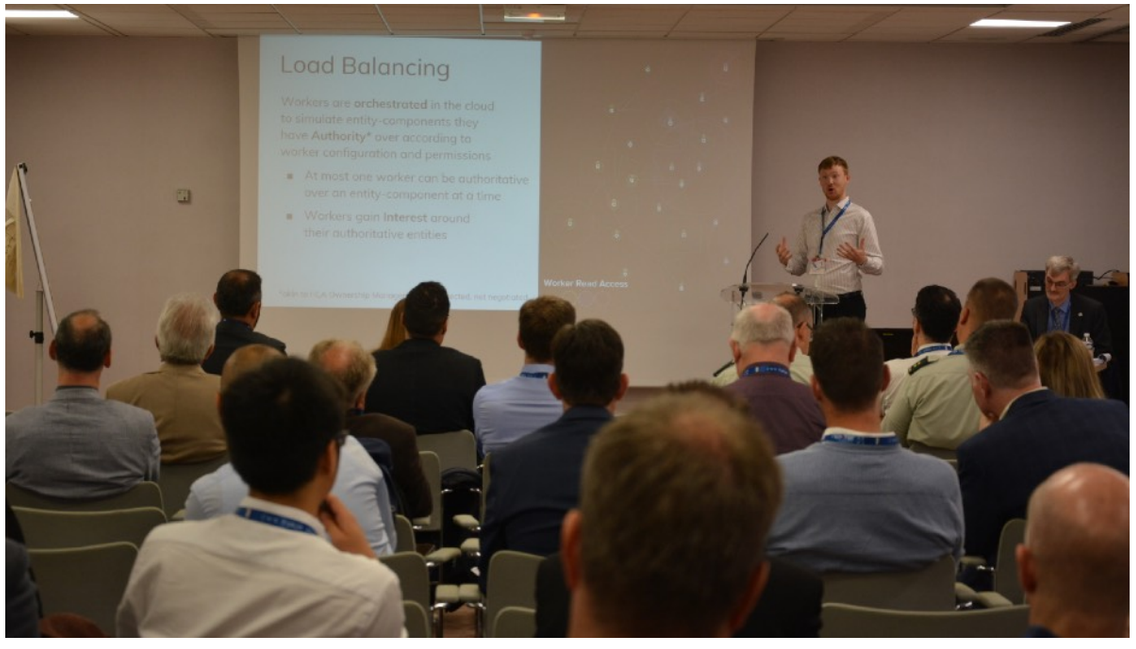
Abstract: This presentation will provide a background to the SpatialOS cloud platform technology, paradigm and underlying architecture in the context of enabling greater simulation scale, higher concurrent player counts, and faster innovation in commercial gaming and military training and education applications.

We will explore how the capabilities of SpatialOS support the creation of commercial gaming experiences, and how these can be applied to support and improve training outcomes. We will identify benefits, challenges and trends in bringing SpatialOS to the military M&S domain, including enhanced simulation complexity and training immersion, approaches to simulation interoperability, the increasing adoption of commercial games engines, and trends in cloud availability.

Finally, we will present current SpatialOS activity on projects in the UK and US, demonstrating the work being actively undertaken with SpatialOS by Improbable and partners.



Bio: Karl is a Technical Product Manager in Improbable's Enterprise division, which is focused on helping enhance military simulation and training capabilities using SpatialOS, a cloud-native distributed compute platform. A computer scientist by training, Karl has held a variety of software engineering roles since joining Improbable in 2016, and is now working to develop Improbable's roadmap to support international military training and planning capabilities. As part of this work, Karl works on UK defence projects, as well as supporting defence and commercial gaming industry partners in leveraging SpatialOS for modelling and simulation applications.



9.35h-10.00h

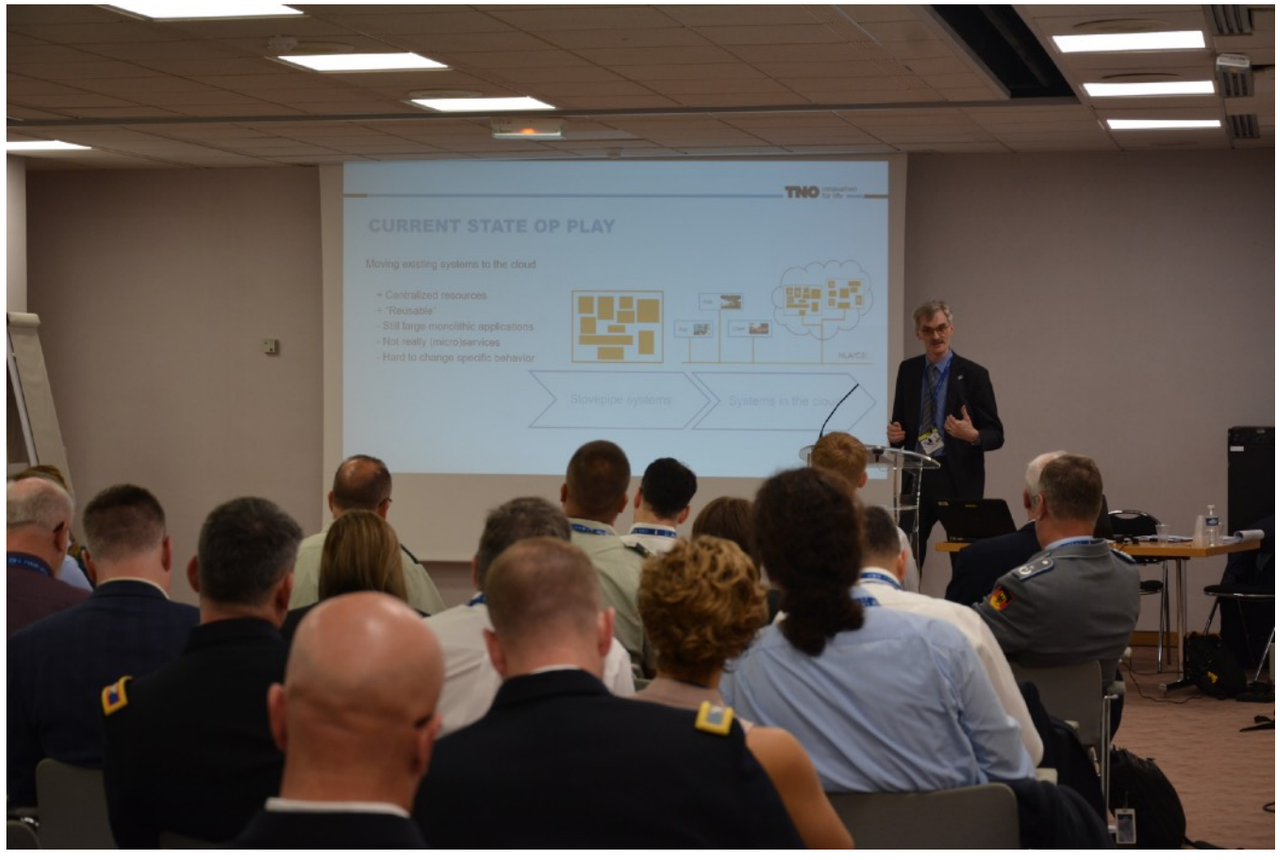
Scalable Dynamic Synthetic Environments using a Next-Generation Game Architecture

Dr Ruben SMELIK (TNO Defence Research, NLD),
Robbert KRIJNEN (TNO Defence Research, NLD)

Abstract: For some years now, the M&S community is transitioning from the traditional large, monolithic stove pipe based systems to Modelling and Simulation as a Service (MSaaS). By running systems on virtual machines in the cloud, their accessibility and reusability is improved, and the deployment and configuration of hardware and software has become less cumbersome and time-consuming. The question remains, however, whether MSaaS in its current form is really the next-generation simulation architecture that will be able to cope with the ever increasing demands in scale, level of detail and accuracy of military simulation systems.

A current trend within the commercial game development community, to enable massive online worlds, is to develop microservice-based solutions and platforms (e.g. SpatialOS, Coherence, cloudgine, Amazon Lumberyard). These microservices promise to deliver on *scalability* (by off-loading large datasets and intensive computational work to the cloud and providing automatic load-balancing), *correlation and fair-fight* (e.g. by means of a shared world model), *separation of concerns* (SMEs can work on specific microservices, e.g. vehicle trafficability, physics-based destruction), *centralised scenario configuration* (versioning, management and monitoring), and more.

In this presentation, we discuss the application of a microservice platform to enable a dynamic synthetic environment, and see if it makes good on these promises. The experiment focused on a building destruction use case, with both a simple model-switching as well as a complex physics-based destruction approach implemented as a microservice running in a commercial cloud-based game platform. We examine challenges encountered while moving to the microservice paradigm and practical considerations when reusing a commercial game architecture for M&S, and give an outlook on the way ahead, providing our view on whether this is the right path towards a truly next-generation simulation architecture.



Bios: Robbert Krijnen is a scientist at TNO since 1996 and has a MSc degree in computer graphics from Delft University of Technology. He specialises in the use of virtual environments for serious gaming applications. His current work focuses on innovations in the field of Augmented Reality and Virtual Reality applications for 'Training & Education' and 'Concept Development & Experimentation' applications in the military domain.

Dr. Ruben Smelik is a scientist at TNO since 2007. He holds a MSc degree in computer science from Twente University. He earned a PhD degree from Delft University of Technology based on his thesis on the automatic creation of 3D virtual worlds. His current
work focuses on innovations in the field of automated synthetic environment modelling for military simulation applications

10.00h–10.25h *Accelerate Training Digitization with Game Engines*

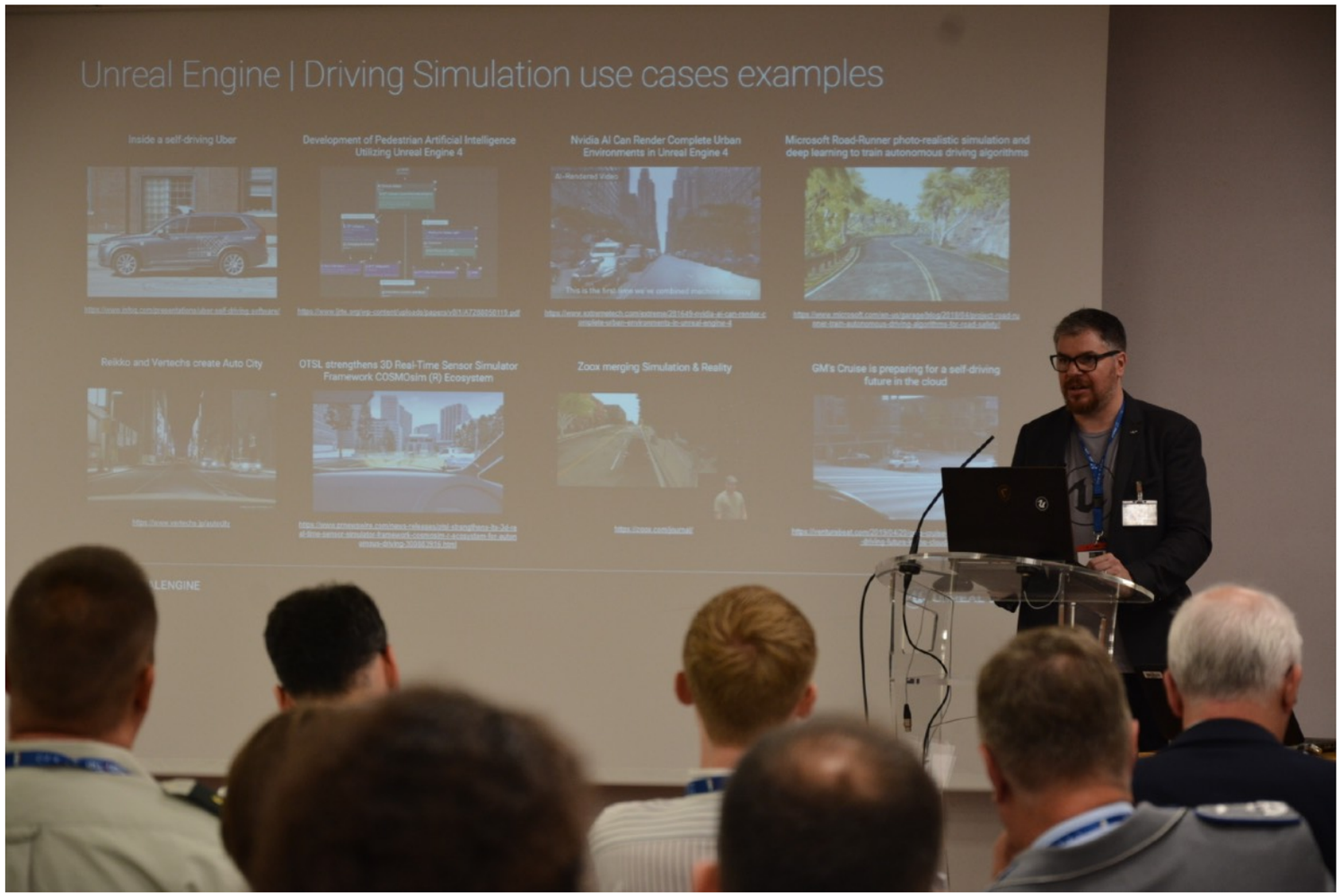
Sebastien LOZE (Epic Games, CAN)

Abstract: As we enter a new era in battlefield digitalisation, new challenges arise. The NATO nations need to keep up with the pace of evolving disruptive technologies while preserving investments from the past. Everywhere we look, digital twins, synthetic environments, and new ways to learn and share information are becoming day-to-day reality for consumers. In our houses, in our cars, and on our wearables, entertainment and gaming techniques represent an unbelievable potential to transform our daily routines.

Only ten years ago, training techniques were ahead of the technology curve, and the defence industry was the R&D stimulator of the virtual worlds. CGFs, SAFs, Geospatial intelligence, and use of high-performance computing systems were the drivers of innovation, and continue to drive more innovation to this day. In parallel, over the last decade, while the “technology debts” from the main defence contractors grew, the gaps between hardware performance, accessibility, and the needs of the next generation of software disappeared.

Compared to previous training solutions, the next era of digitalisation will be less hardware-intensive and more software-intensive. Because they reach a far larger audience than specialised tools, game engines coming from the commercial sector can help build a bridge between the innovation needs and the expertise of the defence sector.

This presentation will discuss this transition, and will open the conversation about how this collaborative innovation bridge can be created with the nations’ leadership and with the industry.



Bio: Starting his career in the modelling and simulation community more than 15 years ago, Sébastien was working for Engenuity as a software engineer for the implementation of the lesson planner scenario generator (LPSG) of the Eurofighter Typhoon training solution as well as several other European projects. After moving to Montreal, Canada in 2006, he has been working on the COTS integration at CAE and the Presagis focusing on Simulation and Visualisation products. Lately he put together simulation and training teams and strategies for emerging companies like CM Labs and D-BOX. After a short incursion in the “real reality” World, managing Rheinmetall Defense Canada European channels, Seb came back into the virtual World. He is now the Simulations Industry Manager at Epic Games. During his career, Seb focused in learning about the latest simulation innovations as well as sharing his experiences about how experts have solved their challenges. If you are building virtual reality applications in order to train machines or train humans he wants to hear from you.

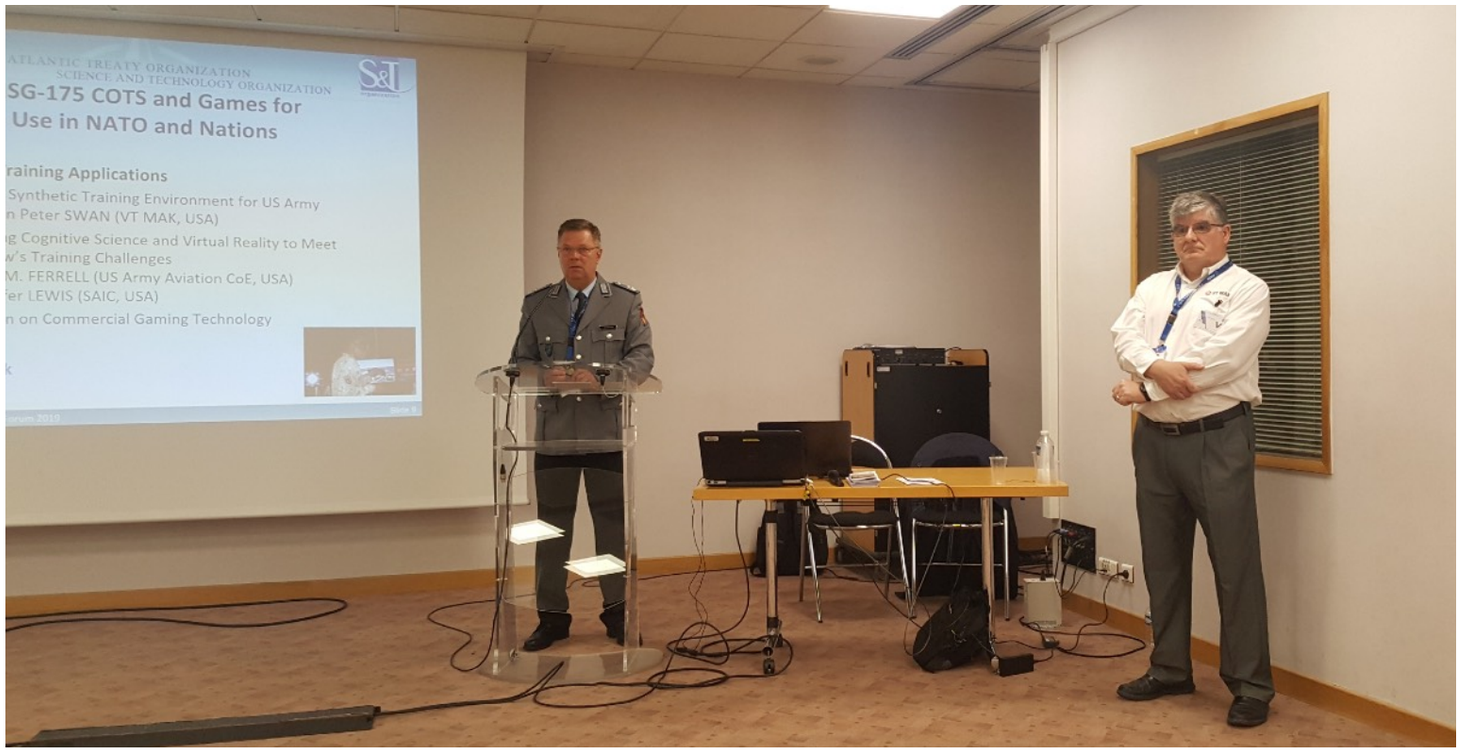
11.00h–11.30h *Common Synthetic Training Environment for US Army Simulation*

Peter SWAN (VT MAK, CAN)

Abstract: The US Army Synthetic Training Environment (STE) will provide multi-echelon collective training and mission rehearsal capability by combining virtual, constructive and gaming training environments into a single platform.

VT MAK has been selected to develop and deliver the Training Simulation Software (TSS) and Training Management Tool (TMT) components of the STE Common Synthetic Environment (CSE). The CSE will deliver the software, applications and services required for mission command training as well as to enable the Reconfigurable Virtual Collective Trainer (RVCT), Soldier Squad Virtual Trainer (S/SVT), and Integrated Visual Augmentation System (IVAS). In addition, the STE CSE will provide the common simulation engine and will allow for interoperability with future STE capabilities such as Next Generation Constructive and Live Training Environment. The MAK CSE solution will be deployed on-premises and in the Cloud to support the army's training at the point of need.

This presentation explains the STE CSE from the MAK perspective and describes how the MAK suite of COTS products will be applied to help the US Army meet its future training requirements.



Bio: Peter Swan is Director of International Sales at VT MAK, a company of ST Engineering North America that develops software to link, simulate, and visualise the virtual world. Mr. Swan has more than 37 years of experience in the modelling and simulation industry in various technical and managerial roles. He has specialised in the development, sales, and product management of modelling and simulation, networking, and synthetic environment software products, in the UK, Canada, and the US. Mr. Swan has held several volunteer positions in modelling and simulation related organisations including Secretary of the Simulation Interoperability Standards Organization (SISO), Chairman of the Executive Committee of the National Training Systems Association (NTSA), Board Member for the National Defense Industrial Association, and I/ITSEC Simulation Subcommittee Member.

11.30h-12.00h

Leveraging Cognitive Science and Virtual Reality to Meet Tomorrow's Training Challenges

Col John M. FERRELL (US Army Aviation CoE, USA)
Ms Jennifer LEWIS (SAIC, USA)

Abstract: In the U.S. military, flight simulation is nearly as old as aviation itself. Simulators have enhanced nearly all flight training programs in the U.S. military since before WWI, from rudimentary, hand manipulated wooden simulators to the Link trainer ("Blue Box") to the advanced high-fidelity virtual simulators in use across the military and commercial sectors for civil and military training. Recent advancements in the commercial gaming industry with virtual reality hardware, coupled with greater understanding of cognitive science and artificial intelligence have captured the attention of military leaders, leading to several initiatives to explore greater use of virtual reality trainers for initial entry (ab initio) flight students.

The U.S. Air Force (USAF) partnered with the U.S. Army Combat Capability Development Command to develop a holistic approach to re-design ab initio training around a student-centred learning model in order to greatly accelerate students through their initial phases of flight training. The USAF Pilot Training Next (PTN) program proved highly successful by graduating 13 students from its first class, at the same proficiency standard in only 6 months, a vast improvement from the normal 12 months in the legacy industrial process. These students have moved on to more advanced training and are performing as good or better than their counterparts in many aspects of their training progression. PTN's holistic, individualised approach is a part of the 'Learning Next' (LN) concept and integrates simulation-based training tools into a multi-modal, student-driven academic approach.

This approach and allowed significant advances in distance learning, as evidenced by trial programs at the US Air Force Academy (USAFA). The learning environment also implements machine learning techniques to identify and score in-flight manoeuvres, leading to more data-driven assessments of student progress, allowing instructors to focus on the art of flying. One of the key aspects of PTN that helped accelerate learning was the scale and availability of the training systems, which students could access in their free time and which were made available in their apartments.

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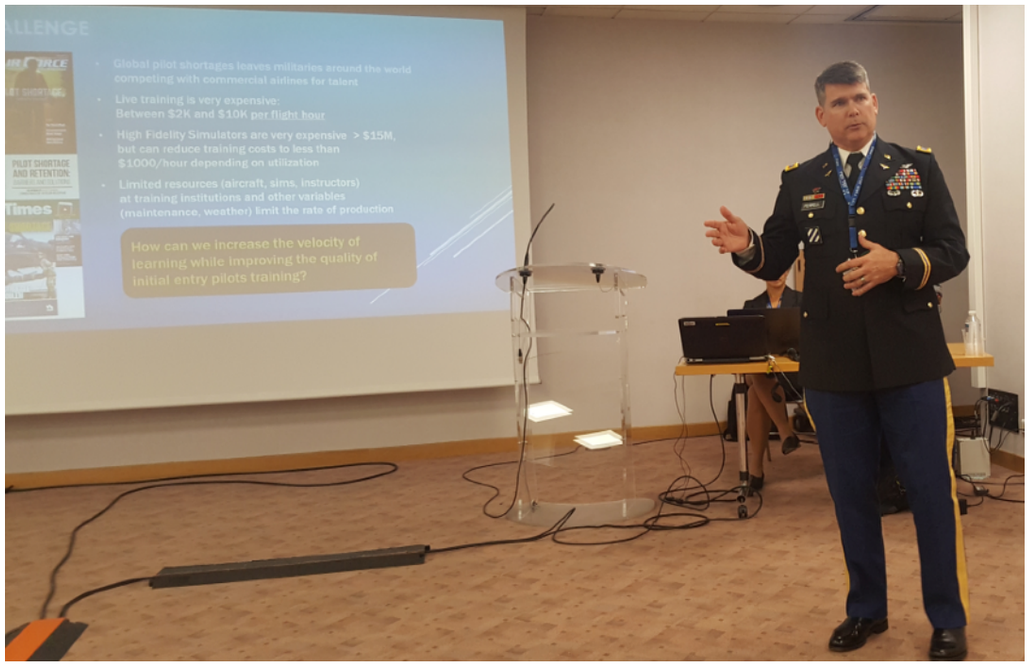

Bios: Colonel John Ferrell is the Director of the Directorate of Simulations at the U.S. Army Aviation Center of Excellence, where is responsible for all training simulations for the Aviation school which trains aviators, air traffic controllers and flight operations specialists. He also serves as the accreditation authority for all aviation simulators globally and is the senior advisor the Commanding General of the Aviation Branch on all simulation matters, currently focused as the senior aviation representative to the development of the U.S. Army's synthetic training environment.

Jennifer Lewis is a principal software engineer who has developed interoperability solutions for distributed training and analytic live virtual and constructive (LVC) simulation environments for the US Army and US Air Force for the past 17 years. She holds a Master of Science in Computer Science with an emphasis in Telecommunications and Networking from the University of Texas at Dallas and is a Certified Modelling and Simulation Professional.

11.30h-12.00h

Leveraging Cognitive Science and Virtual Reality to Meet Tomorrow's Training Challenges

Col John M. FERRELL (US Army Aviation CoE, USA)
Ms Jennifer LEWIS (SAIC, USA)

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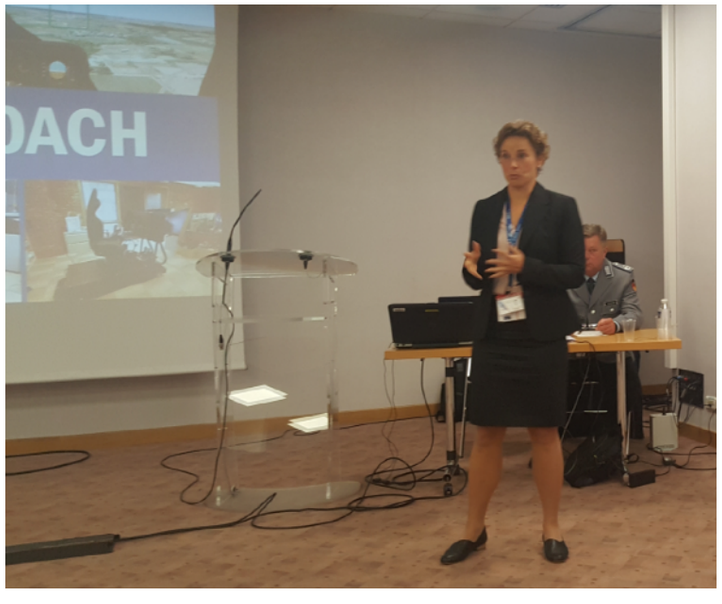
Building upon the success of PTN, the U.S. Army Aviation Center of Excellence, established its own pilot program, known as Aviator Training Next (ATN), leveraging many of the same tools and student-centred learning models under the LN concept. With a very different flight school model in the U.S. Army, the ATN approach required a more controlled and limited approach, but will build on the lessons learned and leverage the same technologies along with the cognition and learning science principles of PTN. The experiment is supported by various research organisations and will seek to answer key questions about the use of VR and intelligent tutoring for flight training. The key research questions the Army seeks to answer are:

1. Is VR a viable source as a training tool in aviation tasks?
2. Is VR and intelligent tutoring able to effectively train specific aviation tasks?
3. What is the effective/proper amount of VR, by percentage, for training aviation tasks?
4. What is the proper combination of training modes (classroom, sim, part task trainer, VR, aircraft) for training aviation tasks?
5. Does the time to task proficiency change with the inclusion of VR as a training tool? Does increased access to low-cost training devices outside of scheduled work hours accelerate this time to task proficiency?
6. What are the human performance impacts of VR exposure?
7. Does this VR device cause sickness and at what percentage?

Using the Army's ATN program, this presentation will describe LN's technical architecture and discuss the value proposition of LN's technology choices, to include VR Head Mounted Displays (HMDs), options for simulation and learning technologies interoperability (e.g. DIS, xAPI), and open source and enterprise data collection and visualisation systems. LN intentionally provides prototype solutions using a variety of simulation/game engines (e.g. Prepar3D, XPlane, Unity, Unreal) and learning management solutions (e.g. Moodle, Learning Locker, Watershed). This presentation will discuss lessons learned with each approach and recommendations to provide military training at scale with today's technology, including an eye to integrate future innovations quickly. Finally, this presentation will discuss technical challenges LN encountered, such as the need for ultra low latency solutions for multiplayer training and the need for students to perform fine motor movements using their hands in a VR space, which industry must solve before commercial gaming will be a truly viable option for formal military aviation training.



14.00h-14.25h

Vae Robusta / Woe to the Strong: and HLA MS2G for Hybrid Warfare

Prof Agostino BRUZZONE (Univ Genua, NATO M&S CoE, ITA),
Col Paolo DI BELLA (Univ Genua, NATO M&S CoE, ITA)

Abstract: In Modern Warfare, the Time itself is a commodity. A Commander on the battlefield might want to decrease or increase the speed of confrontation due to different reasons, for instance, when he faces shortfalls or when he's gained the momentum. Time could be considered as the main commodity in war fighting, while the currency is risk. Risk it is difficult to assess, and however taking too much risks drives the Commander quickly out of credit; on the other hand, time it is a given physical dimension quite well understood and manageable. While most of the military commanders in History economised the risks and possibly had the luxury of ignoring the time dimension, no one, but Napoleon understood that together with risks management, time had become already in the XIX century the cutting edge tool of the winners. Intended as a commodity, time looks like at first as an endless resource, but we learned from the Vietnam conflict, as well as Soviet War in Afghanistan, that even a major military power could erode this commodity without achieving nothing, but useless "pure" military victories.

In such situations Time, if not well managed, drag the conflict into a lengthy war of attrition or lead eventually to war exhaustion, a limit that is as well unpredictable as ineluctable. The remedy could lie in an increased lethality of the military means on the battlefield driven by an accelerating speed of confrontation, coupled with the proper political narrative displayed on the social and media dimension and robust measures of hybrid and cyber defences. In particular, the political narrative, even weak as pure military mean, if it is not mastered properly, could undermine the support and the resiliency of the public opinion especially in Evolved Democracies such as in Western Countries. From such perspective, the paradox of the contemporary Hybrid conflicts is that a Commander could have to face the dilemma of balancing the advantage of a decisive military victory against a different narrative given by the media. Solicited by the opponent. As example, in a civil war such as the Afghan conflict, it could be the case that figures of insurgent losses have to be rounded down for political reasons; this is because of the negative effect of advertising overwhelming losses of sons of the mother land (even if sided on the wrong side) on the media. Modelling and Simulation (M&S) from such perspective provides the possibility to explore such not winning scenarios, providing Analysis and Mission planning tools to support operational decision-making. The future Hybrid conflicts, that we strongly hope will be confined in simulators and exercises, will challenge more and more the Decision Makers and the Commanders on the battlefield with the paradox of pure military victories potentially corresponding to no marginal political gains. This could be even truer within an Hybrid environment characterised by an aggressive counter narrative and Cyber Attacks brought by Hostile actors.

…(see next page)

Bios: Agostino Bruzzone is a Professor and has been appointed as President of MIPET and Council Chair of STRATEGOS, two International Programs of Genoa University; he is President of Simulation Team and created as Project Leader a new research Track in NATO STO focused on Simulation for Extrended Maritime Framework

Paolo Di Bella is a Colonel in Italian Army and served overseas including two times in Afghanistan, last one in 2018; he was a responsible of the NATO M&S COE and currently he is completing his PhD Program in Mathematical Modelling and Simulation

Vae Robusta / Woe to the Strong: and HLA MS2G for Hybrid Warfare

Prof Agostino BRUZZONE (Univ Genua, NATO M&S CoE, ITA),
Col Paolo DI BELLA (Univ Genua, NATO M&S CoE, ITA)

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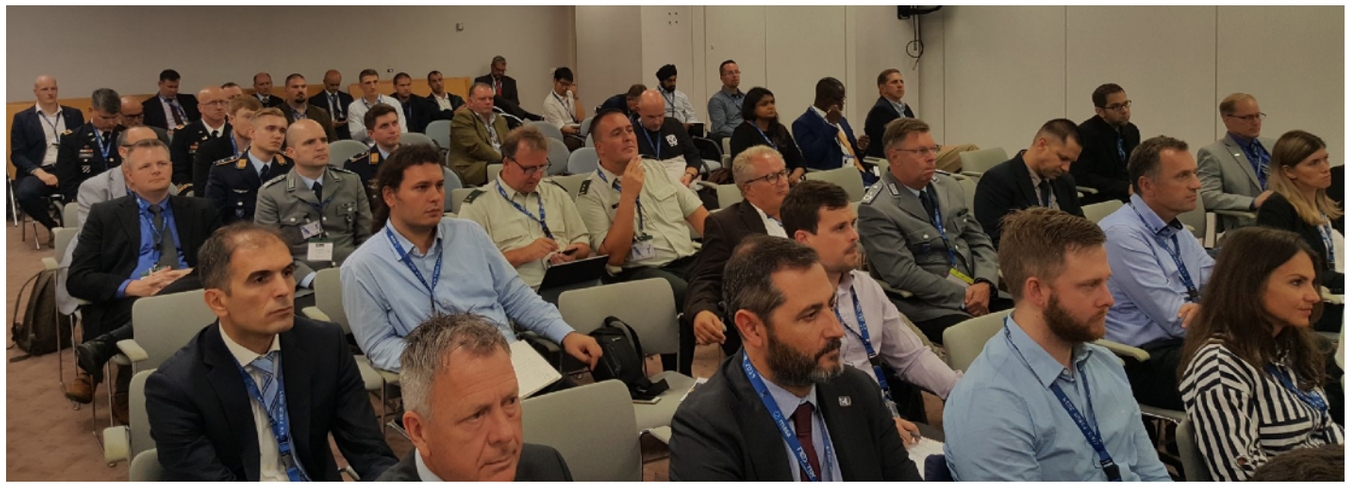
In this paper, the authors will use stochastic agent driven interoperable to tie these aspects on a realistic scenario in order to allow the users to experience these mission environments as well as criticalities in terms of time and public opinion. The idea of the user is to to create an intuitive, interoperable and interactive application that incorporates the MS2G Paradigm (Modelling, interoperable Simulation, Serious Games); in this way the advantage to have an open simulator, ready to interoperate with other systems by adopting HLA standard, is merged with the advantage of a Serious Game Approach, engaging users to maximise usability and interest.
The application of the proposed simulator is currently focused on Education and Training and it proposes major political objectives for confrontation to the player; users are expected to experience in this framework the problem of properly calibrating the military and hybrid means to achieve these main objectives. The Use of Intelligent Agents (IA) allows playing the game at high level while the IA carries out COAs, so even decision makers could use it, by running fast simulations. The simulator includes also some basic self-assessment feature to support them in the process of investigating mission environments and exploring consequences of different strategic decisions. In particular, in the proposed simulator, the following dimensions are implemented:

a) The time availability: time to achieve results is not known at the beginning, but it is finite. Indeed, in the confrontations over last 50 years, the timeframe from escalation to decommission is usually over 20 years. Decommissioning may occur like asymptotic phenomena, as it currently happens in Afghanistan, however, it could be reasonable to expect that in the future the Western Governments will be less keen than they have been in the past respect the decision to embrace military interventions. In simulation, the player approaching the time threshold will ignite the war exhaustion, meaning the progressive withdraw of the Force and should consider decisions related to diplomatic mitigation actions to be put in place to find out an honourable exit strategy, if possible.



b) Level of Terror: sympathisers of the Insurgents in the Western Countries join the Holy War. Waves of attack that shock the Public Opinion because of their unpredictability and cruelty. The model consider different kinds of actions including the use of off the shelves drones to be massively used as a mean for widespread bombings. Therefore the model consider also the opposite kind of terror affecting domestic the simulation such as the rise of the far right extremists with Racial and religious Pogroms. These events could generate more instability despite more Police and more military on the roads and create social tension. In fact, these elements affect the War Scenario, inside and outside the borders of the Western Countries, and deface the civil and democratic coexistence.

c) Level of Social Media Actions: different parties will use socials to carry out media attacks that ramp up the social tension and destroy trustiness in Institution creating additional vulnerabilities and affecting the political capability to finalise decisions to avoid the consensus crisis; obviously these elements impact on the Commander.

d) Level of Cyber warfare: enemies of the coalition, anarchist and even criminal panels may join the confrontation to have their gains. The consequence of an escalation toward an unrestricted cyber warfare are as much unpredictable as difficult to control. The paper proposes the scenario description as well as Key Performance Indicators to be used as MoM (Measures of Merits); the functionalities and user modes are presented with the general architecture. Some of the simulation modules are proposed to users as results obtained by data analytics from socials and sensor network in order to present the mission environment in similar way to the decision maker perception of a realistic cases. The authors are working to experiment sessions in synergy between Academia and Defence Organisations**.**

14.25h–14.50h

Try-Buy-Adapt

Amit KAPADIA (U.S. Army PEO STRI, USA),
Richard OSBORNE (The MITRE Corporation, USA)

Abstract: As part of the 2016 National Defense Authorization Act (NDAA), the U.S. Congress stated that current DoD acquisition procurements are “from another era”. The NDAA observed that the Department of Defense (DoD) has not adjusted to the pace of rapid modernization seen in the industrial marketplace “to maintain technological, military, and economic superiority.” The commercial sector is developing key technologies and applications that have the potential for cost-effective adaptation for defense use cases such as mission rehearsal and training. The exploitation of commercial technologies and use of open architectures can improve efficiencies, enabling the military modeling and simulation community to effectively respond to dynamic environments with rapidly changing threats. The DoD acquisition community is gradually migrating from a government-based waterfall development method to an approach that leverages commercial technologies quickly and effectively.

In 2019, The U.S. Army Program Executive Officer for Simulation, Training and Instrumentation (PEO STRI) released an initial cyber training prototype as well as a subsequent release within one year of receiving funding. A Try-Buy-Adapt acquisition strategy and a microservice architecture for capability development represent two core enablers of the rapid approach. The approach delivers rapid, point-of-need training to U.S. warfighters that will ultimately refine military readiness. In the Try-Buy-Adapt strategy, the Army seeks commercial solutions that allow the Warfighter to “try” existing capabilities and products and evaluate them against current training needs. If a solution meets a need (or a partial need), the Army “buys” and “adapts” it to integrate with existing training systems, supporting a Development Operations (DevOps) model with acquisition, combat developer, and immediate operational user feedback.

The Army is using the Try-Buy-Adapt approach to acquire the Persistent Cyber Training Environment (PCTE), a holistic cyberspace operations training platform to support individual, collective, and force-on-force training needs. The PCTE mission is to solve significant DoD gaps—specifically, the capability to effectively plan, prepare, and execute Cyber Mission Force (CMF) training. Today, CMF training scenarios are manually deployed on a variety of cyber range resources using varying technologies that often lack fidelity, interoperability, reusability, and the ability to scale to support projected CMF demands. The PCTE platform intends to address these gaps by delivering tools that enable CMF personnel to efficiently plan, prepare, and execute cyber events. These capabilities are acquired through competitive Cyber Innovation Challenges (CICs) in which Warfighters participate in hands-on focus group sessions with selected vendors to “try” and evaluate a vendor’s commercial capability. If it suffices, the Army “buys” the capability by putting the vendor on contract to further develop and integrate their product with other vendor capabilities that are part of the PCTE platform.

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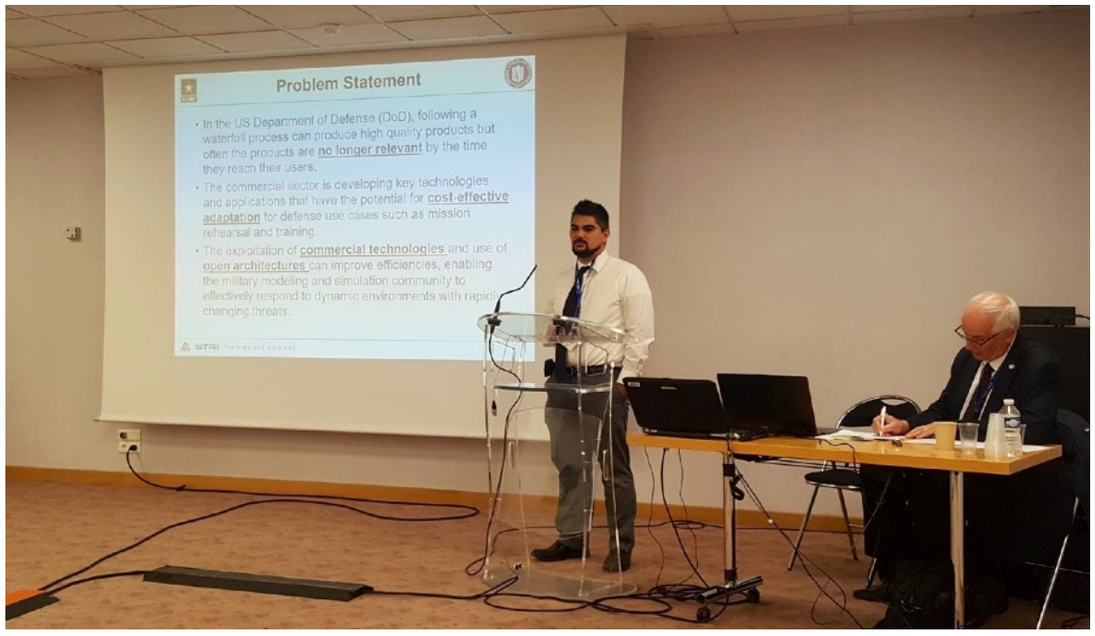

Bio: Mr. Amit Kapadia is the Product Manager Cyber Resiliency and Training (PdM CRT) Chief Engineer at the U.S. Army Program Executive Office for Simulation, Training and Instrumentation (PEO STRI). He provides technical direction and oversight for the PdM CRT portfolio that features the Persistent Cyber Training Environment (PCTE), Army Acquisition Blue Team, and National Cyber Range Complex (NCRC). Amit has worked in a variety of domains supporting the acquisition of test instrumentation, live-virtual-constructive simulations, and Mission Command Systems. He received his Bachelor and Masters of Science degrees in Electrical Engineering from the University of Central Florida.

Mr. Rick Osborne is a Lead Simulation Engineer at The MITRE Corporation. He is currently the chief architect for the Persistent Cyber Training Environment (PCTE) program at U.S. Army PEO STRI. He earned his B.S. in Computer Engineering from Christopher Newport University and M.S. in Modeling and Simulation from The University of Central Florida.

Try-Buy-Adapt

Amit KAPADIA (U.S. Army PEO STRI, USA),
Richard OSBORNE (The MITRE Corporation, USA)

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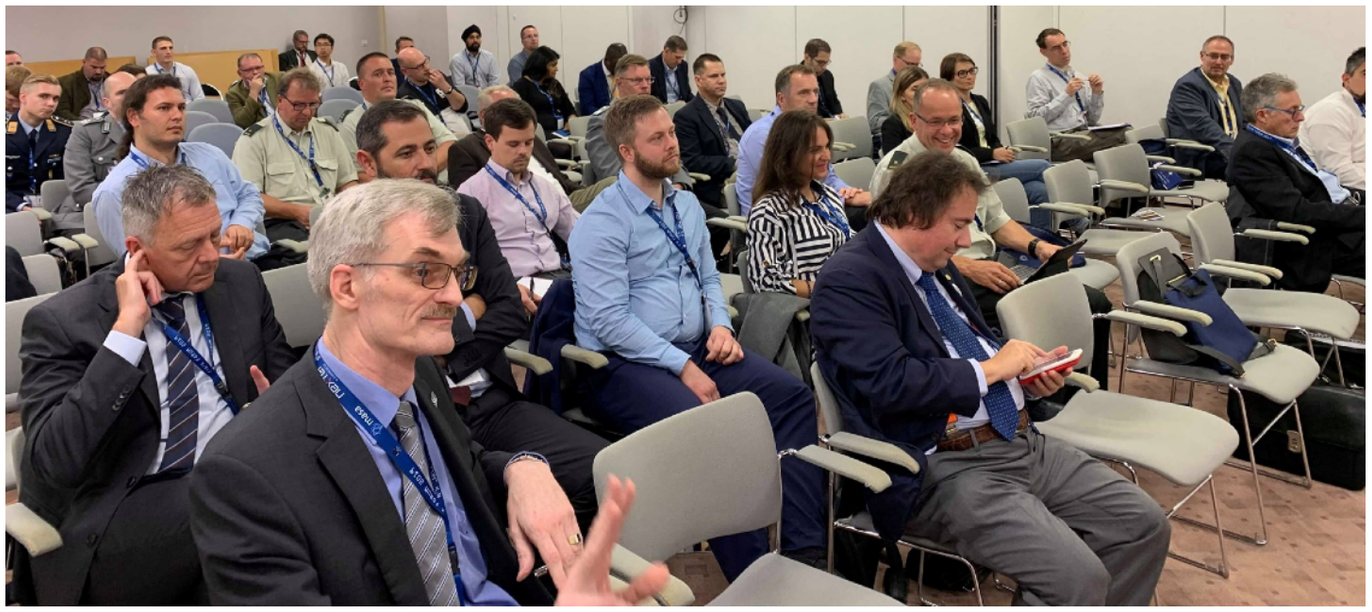
In order to “adapt” purchased vendor capabilities, the PCTE program is adopting a microservice architecture. Netflix implements a microservice architecture to deploy its software updates roughly 100 times per day1. This architecture is a collection of loosely coupled services, each which provide a single business capability. The loose coupling of micro-services on PCTE is achieved by mandating that each service provides a well-defined API and that most inter-service communications occur through an event bus. Loose coupling enables vendors to rapidly implement, test, and deploy features to the end-user. A well-defined API enables vendors to view each microservice as a black box, providing the desired outputs to and inputs from the program while allowing flexibility and privacy for the vendor. Vendors are not only able to protect their intellectual property while working alongside other competitors but also able to implement and modify their service with the best technology available at any given time. The military modeling and simulation community cannot afford to continue the waterfall government-based development that takes years to field a capability to the warfighter. Following a waterfall process can produce high quality products but often the products are no longer relevant by the time they reach their users. Acquiring commercial technologies and leveraging open architectures allow the acquisition community to field capabilities in significantly less time.

This paper presents PCTE’s agile acquisition and development strategy for delivering training capability to the warfighter. It presents an overview of the Try-Buy-Adapt process including the innovation challenges used to “try” and “buy” capabilities and the microservice architecture used to “adapt” vendor capabilities. For tightly coupled vendor capabilities, it describes the plan to migrate them to a microservice architecture for “adaptation”. Finally, this paper discusses challenges of migrating to microservices and offers lessons learned and best practices from our experience. Use of CICs (Try-Buy-Adapt), coupled with a microservice architecture throughout a program’s life cycle, enables the Army to rapidly deliver new features to the CMF, and evolve the PCTE platform based on changes to technology, threat, and tactics, techniques, and procedures (TTPs).



14.50h-15.15h

Military Applications for Machine Learning

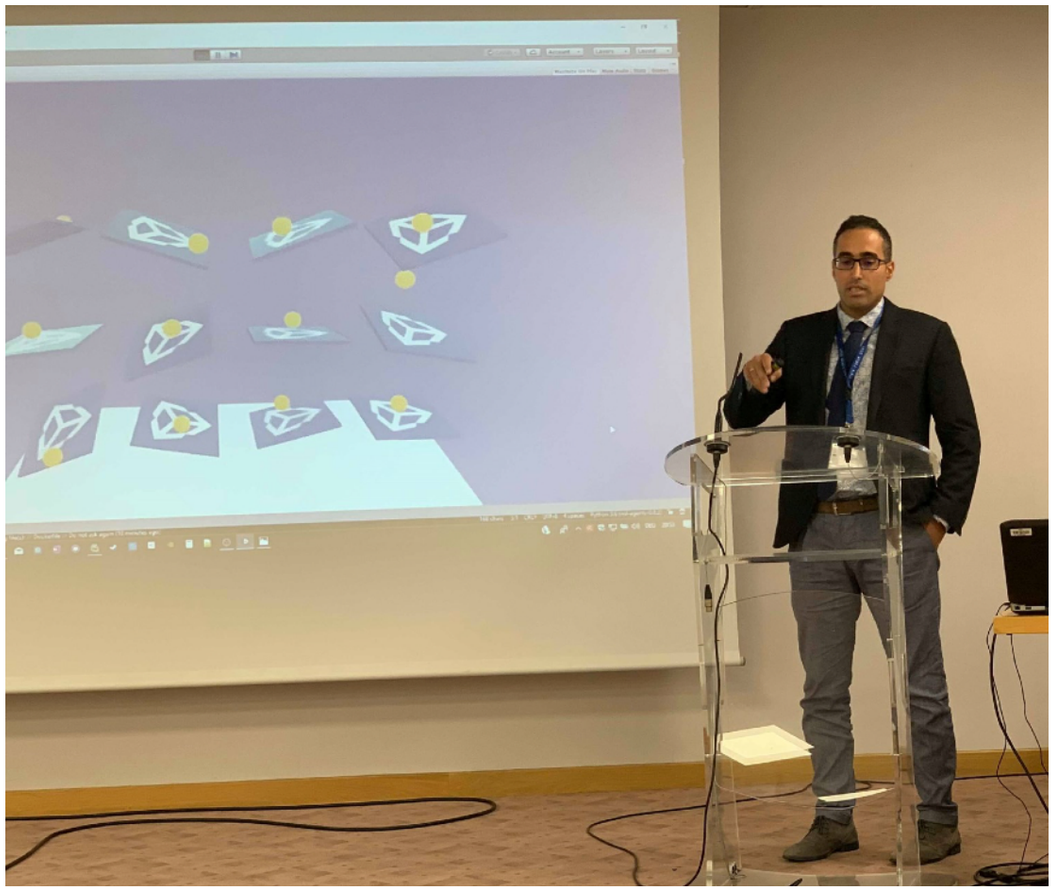
Cpt Ugur UYSAL (Army Concepts and Capability Development Centre, DEU)

Abstract: By using Machine Learning methods and Simulation, artificial intelligence already surpasses humans in board games and computer games. The military applications of Machine Learning and Simulation are promising. This presentation focuses on two military applications for Machine Learning and Simulation: (a) intelligent fire distribution of combat vehicles and (b) classification and detection of military vehicles in images.

The first goal of this presentation is to examine different reinforcement learning methods and their potential to improve the fire distribution of combat vehicles. The game engine Unity is used to simulate a combat scenario between two groups of tanks equipped with various weapons systems. The Unity Machine Learning Agents Toolkit (ML-Agents) provides the framework to implement different reinforcement learning agents and to evaluate their performance against hard-coded decision-tree-based agents.

The second goal of this presentation is to explore to what extent synthetic data can supplement and/or substitute human-annotated data to significantly speed-up the training process and improve the accuracy of deep neural networks for classification and detection of military vehicles in images. Deep neural networks for object classification and detection have already proved to be highly useful in industrial applications but require vast amounts of human-annotated images to be reliable. Here the game engines Unity and ArmA3 are used to generate photo-realistic images of various military vehicles in diverse situations. For instance, the angles and distances from which the vehicles are seen, and their locations can be varied. The synthetic data is used to train deep neural networks, and their performance is evaluated on real-world data.

This work is based on a collaboration between the German Army, Airbus Defense and Space and the University of Central Florida.



Bio: Captain UYSAL is German IT-Officer. After passing Officer Candidate Courses in 2008, he studied Business Computer Science at the German Armed Forces University in Munich and graduated with a master's degree in 2012. From 2013 to 2015 he was supporting the planning and execution of simulation-based military training.

From 2016 to 2017 he was managing the deployment of simulation systems, and he contributed to the advancement of simulation systems used in the German Army. From 2018 he studied Modeling and Simulation at the University of Central Florida in Orlando and graduated with a master's degree in August 2019. His research combines Machine Learning and Modeling and Simulation to improve military capabilities.

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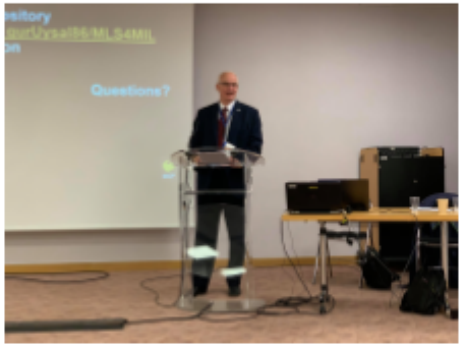

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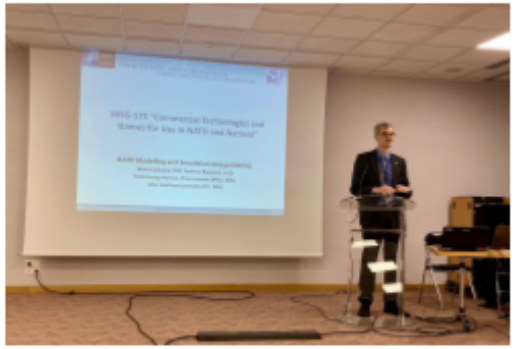

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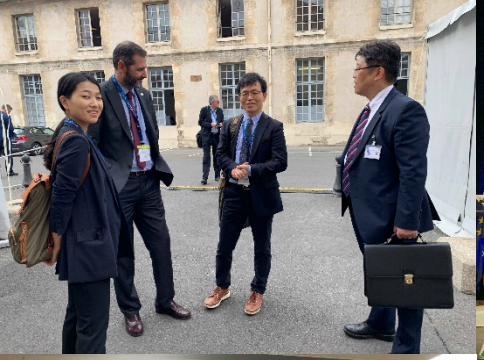
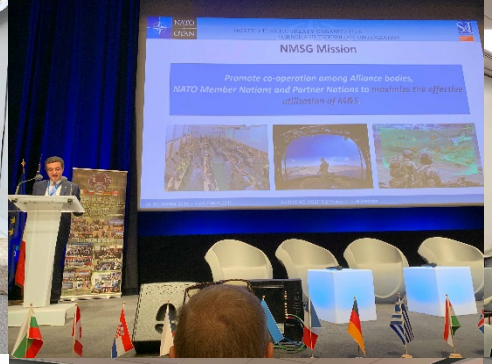
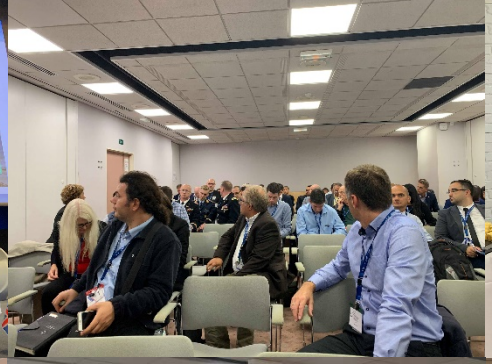
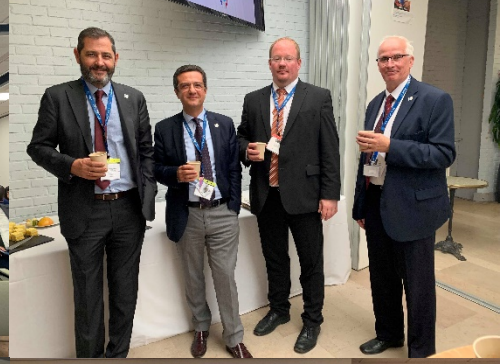
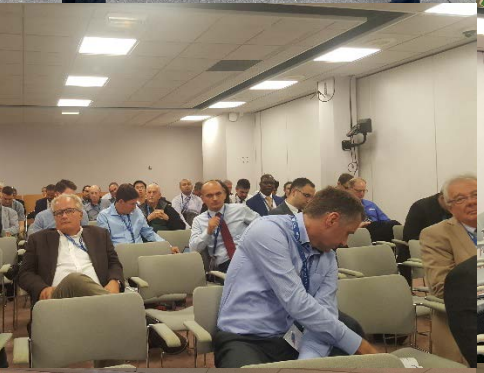
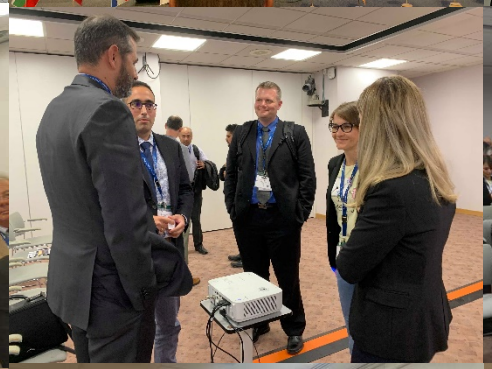
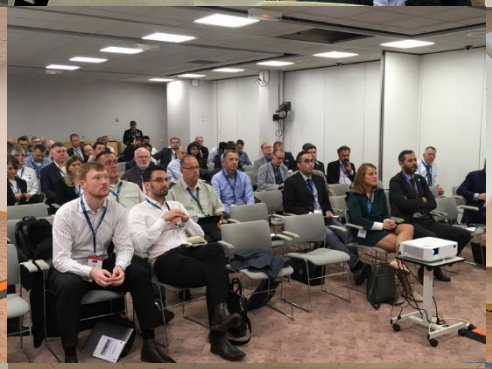
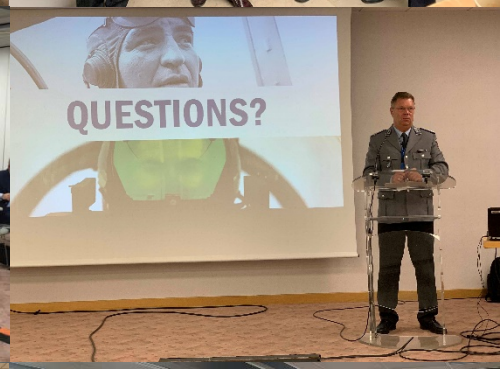


NMSG Mission
Promote co-operation among Alliance bodies, NATO Member Nations and Partner Nations to maximize the effective utilization of M&S.






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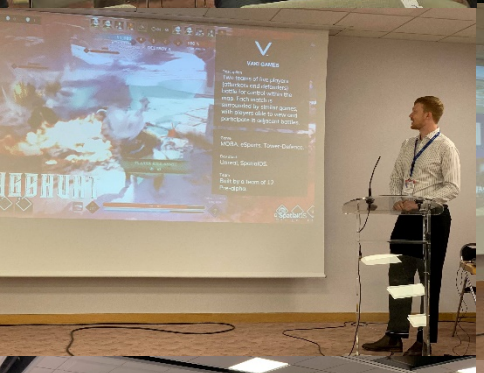
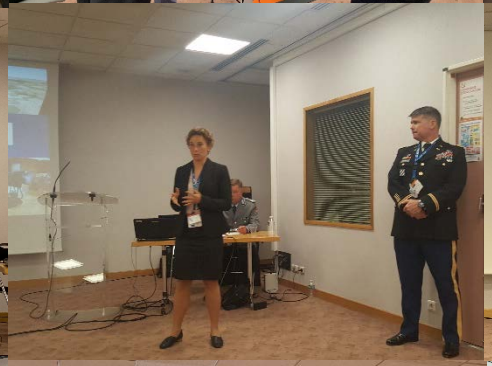
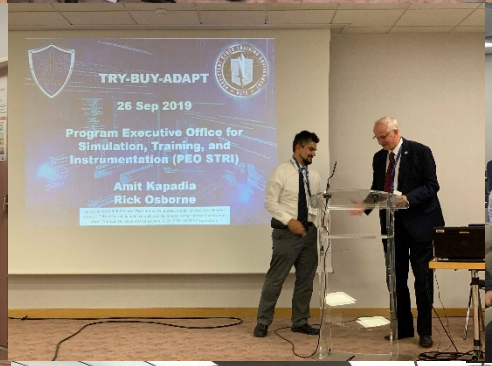
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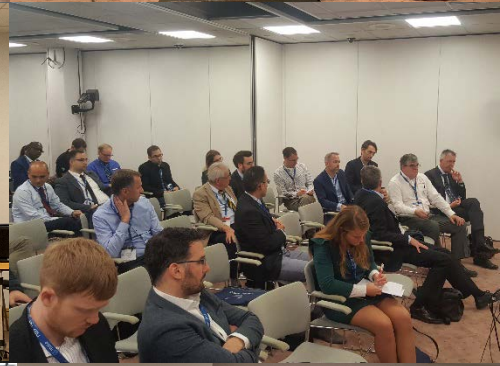
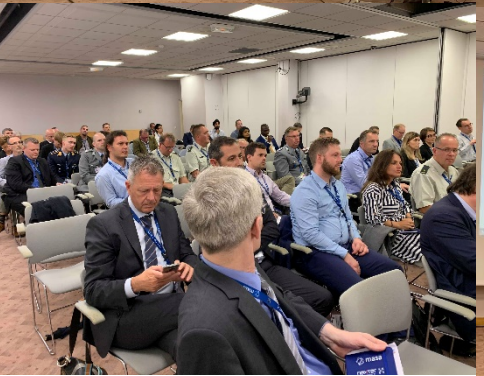
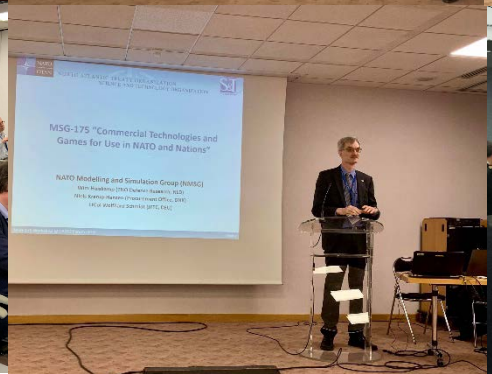
26 Sep 2019
Program Executive Office for Simulation, Training, and Instrumentation (PEO STRI)
Amit Kapadia
Rick Osborne



MSG-175 "Commercial Technologies and Games for Use in NATO and Nations"
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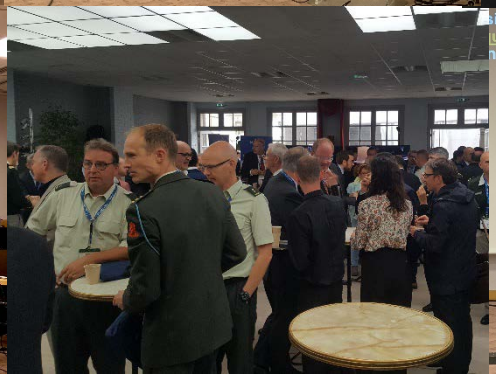
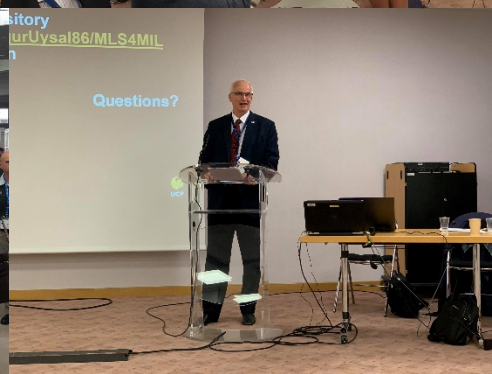
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