Trend Report

Modelling and Simulation Group (MSG) Workshop Series on Exploiting Commercial Technologies and Games for Use in NATO

Project: Contractor Support for HQ SACT NATO
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Executive Summary

Nearly ten years ago, the training and modelling and simulations (M&S) communities teamed up to tackle a burgeoning issue – the use of commercial technologies and games in NATO. The challenge came from the cultural change inherent in the domain. Small businesses were the leaders in the game space, yet they were perceived as risks among acquisition authorities. The proponents pushed forward by forming a Modelling and Simulation Group workshop series called "Exploiting Commercial Technologies and Games for Use in NATO" to bridge the cultural gaps. Over ten years, twelve workshops have convened. Successes have been achieved and predictions made five years ago have been attained.

This report provides (a) findings such as trends and possible explanations for factors contributing to attainment of workshop predications; (b) trends within technology, industry, and government with respect to commercial technologies and games for education and training; and (c) recommendations for consideration in planning future MSG commercial technology and games workshops. A semantic analysis of report text was the primary means of discerning factors and trends. The data (corpus) included 157 pages of workshop reports since 2009.

This MSG workshops series has investigated trends in this area for nearly 10 years. NATO relies on nations and industry to develop the M&S capabilities to satisfy CFI requirements. This report validates four of the MSG workshop predications in these four findings

- Scenario realism continues to improve and shows an association with the level of discussion of social media and the human dimension during workshops.
- Discussions focused on solving new requirements tend to lag the introduction of the topic by three workshop events.
- Discussions focused on user experience have emerged within the workshop reports and persist in current discourse.
- Assessment of training effectiveness, return on investment, and time efficiencies recently emerged as a workshop topic and this will likely continue.

In addition to the objective trend analysis, another trend analysis based on extrinsic market conditions is provided in this report.

Technology	Industry	Government
• Massive Open Online Course (MOOC) • Mobile Learning Technologies • Alternate Reality Games (ARG) • Networks and Architectures	• Open Source or Proprietary • Understanding the Needs of Government eLearning • MOOCs as a Disrupting Technology • Standards for Gaming	• Collaboration • Architecture for MOOCs • Augmented Reality and Virtual Worlds

MOOCs are revolutionizing traditional forms of education and are a key trend to watch, as are alternate reality games. The report also includes some ideas for consideration, which would enhance trend forecasting in this domain. This report concludes with four recommendations for consideration when planning future workshops.

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1.0 INTRODUCTION

About a decade ago, the training and modelling and simulation communities embarked on something new – the use of commercial technologies and games in NATO. This topic was difficult to appreciate in government settings. The challenge was how to use a very capable technology in military training? Acquisition authorities were not amused that customers wanted entrepreneurs as simulation providers. Large defence contractors had the reputation of presenting little risk to acquisition authorities because decades of precedent have established well-known procedures. Meanwhile, small businesses gave the impression as injecting risk. Nations and NATO faced a paradox common in innovation; the issues were cultural as well as technical.

The proponents of using commercial technologies and games decided to move forward and establish a Modelling and Simulation Group (MSG) workshop series called "Exploiting Commercial Technologies and Games for Use in NATO" to bridge the cultural gaps through dialogue and demonstration. Twelve workshops have convened over nearly ten years. The most recent workshop included a review of predictions made five years earlier. All predictions have been realised. This report looks objectively at those predictions and uses factor analysis to determine possible underlying reasons for successes so this trend may continue. It presents four findings and recommendations to enhance understanding the trends of this MSG workshop series relative to market conditions and to help future planning for commercial technologies and games in NATO education and training.

1.1 Scope

NATO Allied Command Transformation (ACT) requested a Trend Report of the last seven MSG workshops in the Commercial Technologies and Games series spanning four and a half years. These workshop reports became the corpus (data) for analysis. Table 1 lists the MSG workshop series reports included in the corpus for analysis:

Table 1: Analysis Corpus. MSG workshop series reports included in the analysis.

Workshop Number	Date and Location	Page Count
MSG-074	May 18-20, 2009; Farnborough, GBR	14
MSG-078	September 22-24, 2009; Suffolk, USA	16
MSG-093	November 2-4, 2010; Rome, ITA	12
MSG-108	October 25-28, 2011; Farnborough, GBR	24
MSG-113	April 16-18, 2012; Genoa, ITA	28
MSG-114	November 13-15, 2013; Kjeller, NOR	34
MSG-130	October 9-11, 2013; La Spezia, ITA	34

This report provides results showing patterns underlying the written text using a form of factor analysis called Latent Semantic Analysis. The purpose of this analysis included: (a) findings such as trends and possible explanations for factors contributing to attainment of the MSG workshop predications; (b) trends within technology, industry, and government with respect to commercial technologies and games for education and training; and (c) recommendations for consideration in planning future MSG commercial technology and games workshops.

1.2 Thesis

Industry and governments continue to support modelling and simulation (M&S) as both a domain and source of techniques and tools that have the potential for cost-effective utilization for NATO strategy formation, education and training, operations, and capabilities development. NATO is shifting its operational focus in 2014 as it withdraws from the International Security Assistance Force (ISAF) in Afghanistan. This will affect operational forces as well as the NATO training structure. In accordance with the tenets of the Connected Forces Initiative (CFI), NATO will redesign a training program to retain operational interoperability gained through years supporting ISAF. Rising training costs require NATO to develop a revised education and training program by using technology having the greatest potential to save resources (NATO RTA, 2013).

This MSG workshops series has investigated trends in this area for nearly 10 years. NATO relies on nations and industry to develop the M&S capabilities to satisfy CFI requirements. This report validates four of the MSG workshop predications in these four findings

- Scenario realism continues to improve and shows an association with the level of discussion of social media and the human dimension during workshops.
- Discussions focused on solving new requirements tend to lag the introduction of the topic by three workshop events.
- Discussions focused on user experience have emerged within the workshop reports and persist in current discourse.
- Assessment of training effectiveness, return on investment, and time efficiencies recently emerged as a workshop topic and this will likely continue.

Commercial technologies and games may help keep education and training costs affordable in to the future. This MSG workshop promotes knowledge sharing about how people are using the technologies. This analysis suggests that increased and continued assessment of underlying relationships among workshop presentations and market environments provides valuable information to leverage collaboration among government and industry.

2.0 METHODOLOGY

MSG-130 convened in October 2013. During the closing remarks and summary of the workshop, the co-chairs noted the workshop series was reaching its tenth year of meetings. Five years earlier, five predictions were made, when the series was five years' old. Subject matter experts reviewed those predictions and the determination was all five objectives had determined those objectives had been attained. Our team designed and conducted a semantic analysis to provide a third party, independent review of the claims. The methodology summarized below supported the analysis well in creating a text model, enabling factor analysis to cluster information, and revealing trends in the workshop series that support the claims.

2.1 Analytic Techniques and Tools

The author relied on a number of commonly available and proven analytic techniques used in the humanities and the sciences. Each of these techniques and the open source tools used to conduct the analysis is further described in Appendix B.

Factor analysis. A family of techniques to study phenomena of great complexity and size in order to discover patterns within the data. It can show complex interrelationships to either unite or separate data into clusters. It is among the most widely used methods (Rummel, 1988).

Latent semantic analysis (LSA). Words in a corpus contain an association scheme typically not visible to a casual reader. LSA is "a powerful mathematical analysis that is capable of correctly inferring much deeper relations, and as a consequence are often much better predictors of human meaning-based judgments" (Landauer, Foltz, & Laham, 1988, p. 4).

Topic modelling. Topic modelling simplifies the analysis of large volumes of text. It uses statistical methods to group sections and discovers patterns that may otherwise go unnoticed (Nelson, n.d.). The power of topic modelling lies in working above the document level.

Singular value decomposition (SVD). Closely related to factor analysis, this technique is the driving force behind LSA. It decomposes a large matrix into a lower order (smaller size) of the most important few – a great aid of deal with large bodies of text (Landauer, et al., 1988).

Exploratory visual analysis. This technique relies primarily on creating and inspecting scatterplots from various datasets. The team used the free, open-source "R" software package (R Core Team, 2013b) to do some graphing and statistical analysis.

2.2 Analytic Process

The analytic process consisted of three primary steps: data collection, including data examination and pre-processing; statistical modelling, using the analytic techniques and tools; and exploratory analysis, primarily visualisation of the data to discern trends in the data. These steps prepared the outputs necessary for trend analysis as described in the Results section.

Data was collected from all technical evaluator reports over the last seven workshop events spanning the period May 2009 (MSG-074) through October 2013 (MSG-130). HQ SACT provided the data in the form of Microsoft Word documents. The data totalled 157 pages of text. Each report received pre-processing to prepare the corpus (text data) for the analysis tools.

- Documents were converted to plain text by removing the graphics and bullets
- Parentheses were removed to avoid the interpretation of a term like "games" and "(games" as two separate words
- Documents were separated by major heading (typically the summary of a speaker presentation) and saved in 177 separate text documents

3.0 RESULTS

The essence of this study was to find trends in the written word to validate predications and assumptions held by NATO management. This section presents each of the four findings – supporting them with data and trends discovered in the analysis. Prior to presenting the findings, Table 2 summarizes the sequential results of the various techniques used to develop the trace graphs, which represent the primary analysis output.

Table 2: Analysis Results. Summary of key results from the combination of techniques.

Technique	Key Analytic Result	Details
Topic Modelling	• Thirty topics generated using the MALLET tool • Reduced to 26 relevant topics for use in LSA	Appendix C
LSA using SVD	• Heat map of 26 topics and 7 documents • Ordered by those most likely to cause trends	Appendix D
Cluster Analysis	• Eleven topics chosen for further definition • Three distinct clusters emerge from the reports	
Topic Definition	• Topic keys used to read report areas showing topic • Eleven definitions generated as shown in **Figure 1**	Appendix E
Topic Trace Graphs	• Show topic frequency chronologically in reports	Appendix F

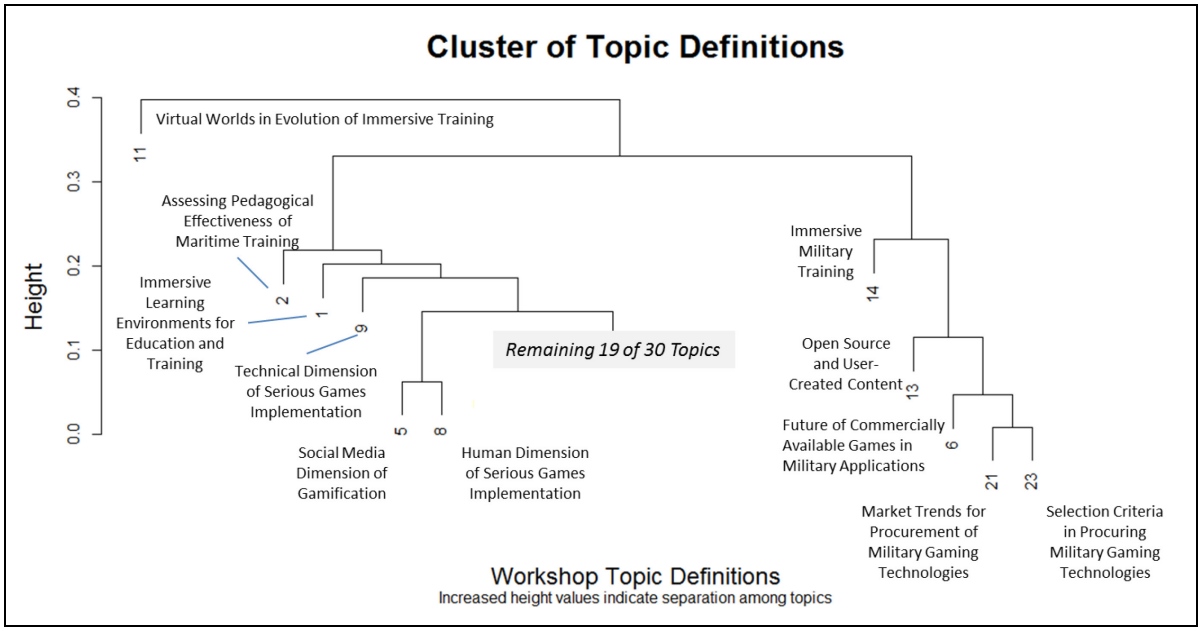

Figure 1: Topic Definitions in Clusters. Combined output of cluster analysis and topic definition.

In 2008, attendees of the MSG Workshop for Commercial Technologies and Games made five predictions as to the future of exploitation of commercial technologies and games:

1 - Highly realistic scenarios would become affordable those outside military training

2 - Training games would be become more realistic than those for entertainment

3 - New types of training scenarios would drive new types of training technologies

4 - Joint missions would drive interoperable solutions

5 - End-user experience would command greater emphasis in development processes

According to the Co-Chairs of MSG-130, all five predictions have been attained by the membership and nations supporting the workshop series. Factor analysis of the workshop reports using trace graphs help validate the claim made at MSG-130 that the predications have been attained. Of note, predication four could not be directly analysed by the trace graphs. The one topic key containing the term "interoperability" (Topic Key C) was among those eliminated from the factor analysis because it was a ubiquitous topic. Therefore, there is no evidence to reject the opinion that prediction four has been attained.

3.1 Finding 1: Scenario Realism Continues To Improve and Shows an Association with the Level of Discussion of Social Media and the Human Dimension during Workshops

This finding addresses predictions one and two. The trace graph in Figure 2 shows the relevant topics supporting this finding. A review of the topics keys for topic 6 is the idea of "realism". The preponderance of these type discussions occurred soon after the predictions were made during MSG-074 in 2009. Meanwhile topics like virtual worlds and immersive learning have been strong topics with good supportive technologies in the last three workshops.

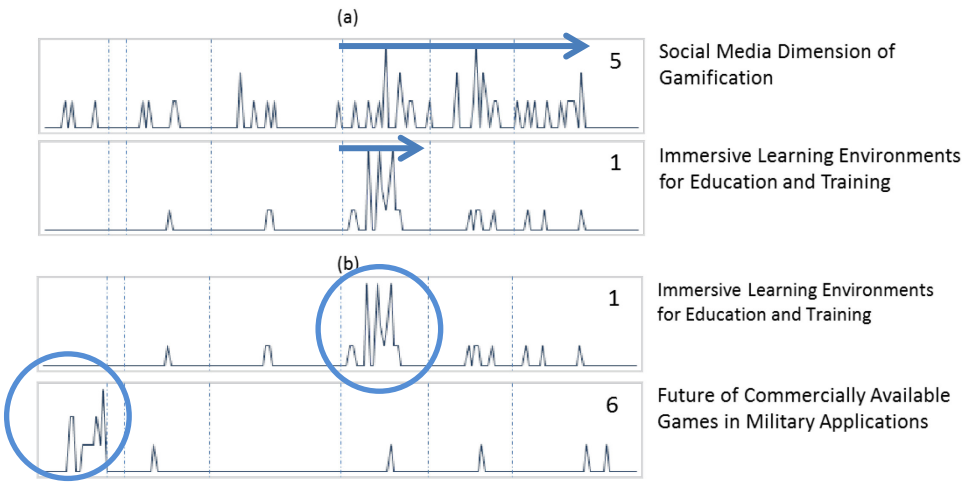

Figure 2: Panel (a) shows an association between the social media dimensions of gamification and the spike in immersive learning environments for education and training in general – without an absolute focus on military training. Panel (b) shows the separation in time of discussions about military specific applications versus immersive learning in general.

3.2 Finding 2: Discussions Focused on Solving New Requirements Tend to Lag the Introduction of the Topic by Three Workshop Events

This finding addresses prediction three. The trace graph in Figure 3 shows two examples of how discussions on requirements and solutions evolve and develop over time. In both panels of the figure, one can see a trend showing the evolution of technical matter to general treatment to emergence of a new discourse. Panel (a) shows the increased sophistication from technical dimensions in the fourth document to assessing pedagogical effectiveness in the seventh document. Panel (b) shows a similar evolution on a topic more directly related to the prediction itself regarding new scenarios requiring new technologies.

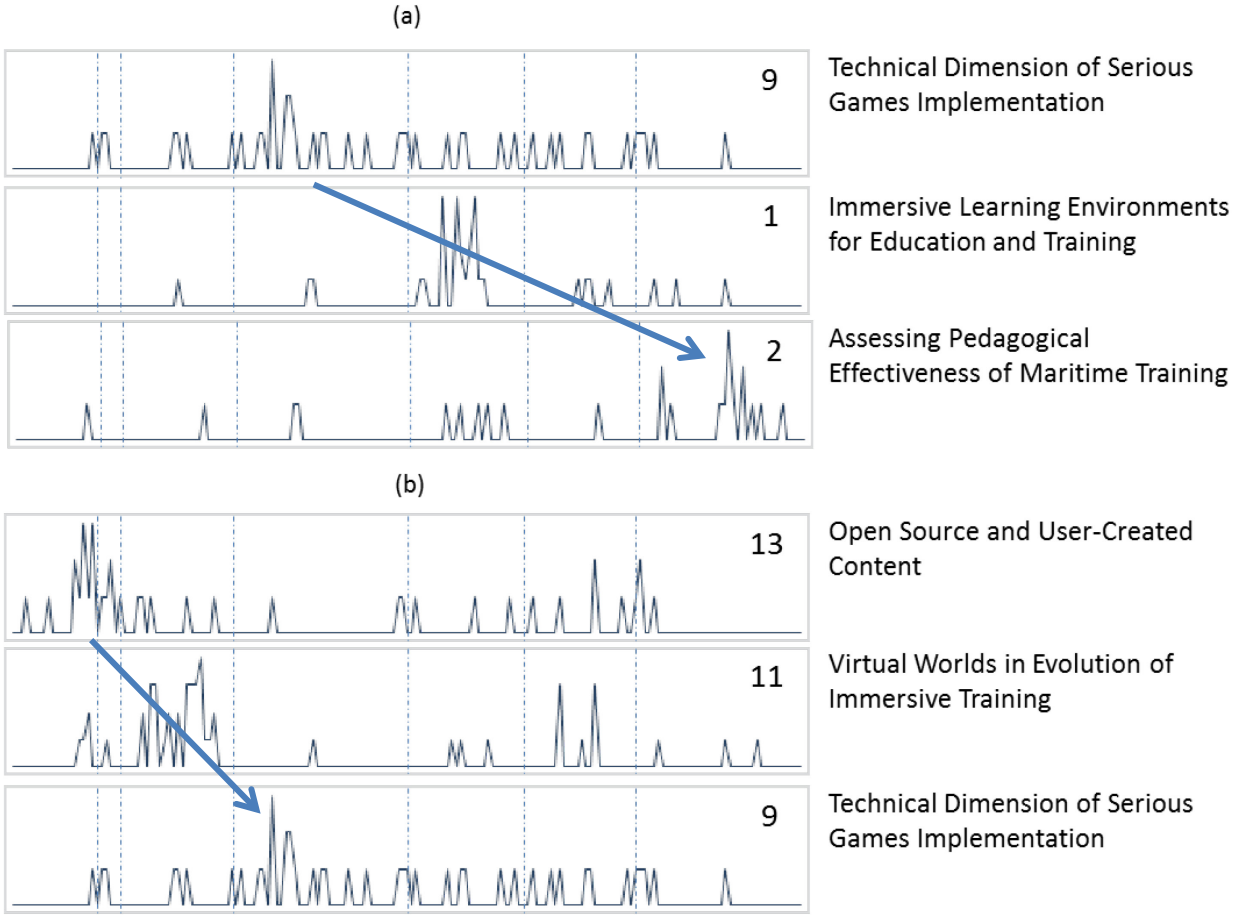

Figure 3: Panel (a) shows the logical progression of discussions about technology, leading to immersive learning environments (ILEs), to assessing results of ILEs. Panel (b) shows another evolution of logic from the need for open source systems to enable user-created, specialized content to the role of virtual worlds and finally the technical implications of supporting new types of training scenarios.

3.3 Finding 3: Discussions Focused on User Experience Have Emerged within the Workshop Reports and Persist in Current Discourse

This finding addresses prediction five. The trace graph in Figure 4 shows a growing and persistent emphasis on the human dimension and social media.

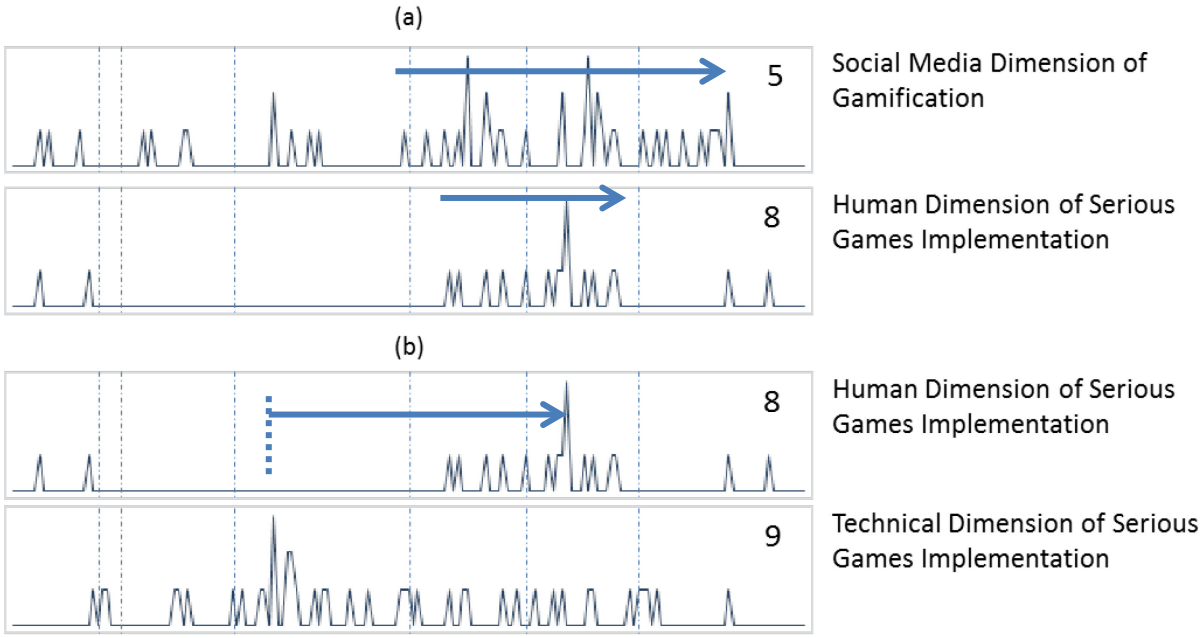

Figure 4: These panels show the trends in the association between the human dimension and technology. Panel (a) shows how discussions of social media emerged and continued for three MSGs. During this time, other aspects of the human dimension emerged. Meanwhile, panel (b) shows the separation of technology and human dimensions of serious games.

3.4 Finding 4: Assessment of Training Effectiveness, Return on Investment, and Time Efficiencies Recently Emerged as a Workshop Topic and This Will Likely Continue

This finding stems not from a prediction but from an observation in the text and from the topic trace graphs. The last four traces in Figure 5 are indicative of topics relating to procurement (some day) of commercial technologies. As the discussion over the workshops continued and the technologies and games proved viability, the trend was to see discourse on assessment of training, time, and capital resources in the latter workshops.

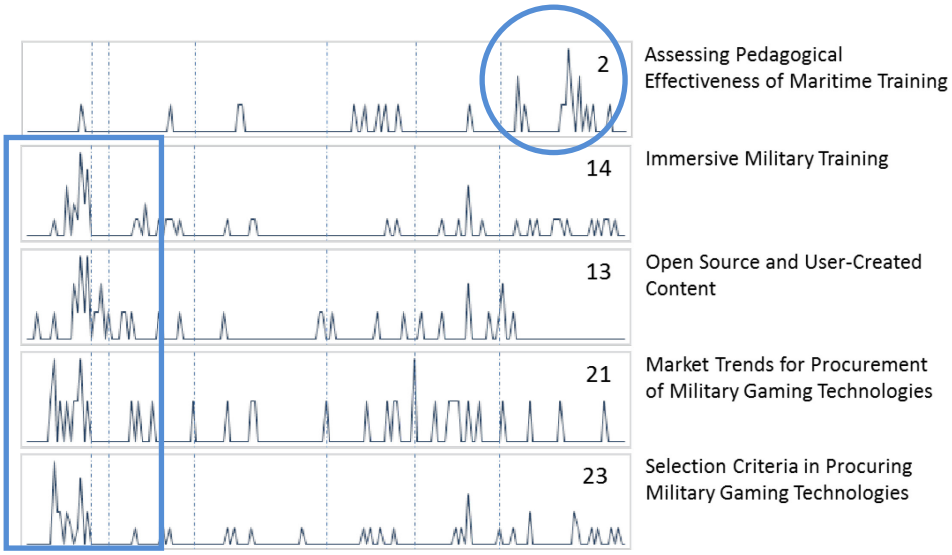

Figure 5: These trace graphs show an interesting contrast between Topic 2 (focused on assessment) and the remaining four topics as ordered by cluster analysis. The peaks of the latter four relate to discussions about acquiring immersive military training technologies. The topics include procurement, standards, proprietary rights, security, verification and validation, and delivery mechanisms. These were strong topics in 2009. They all persisted over four years, but at less level of intensity. Meanwhile, assessment of people, time, and resources has emerged in the latter workshops.

4.0 TREND ANALYSIS BASED ON EXTRINSIC MARKET CONDITIONS

Vincent Barabba (1990) provides some alternative ways to consider market research in his *Harvard Business Review* article entitled "The Market Research Encyclopaedia". He developed the framework to counter the issue he witnessed of market research merely validated decisions already rendered. In his view, the purpose of market research is to identify alternatives from among the environment and then conduct a process to choose the best alternative. He presents five steps:

- assessing information needs
- measuring the marketplace
- gathering and displaying data
- analysing the market data
- evaluating the research for utility

In the very first step, he notes a process to Interpret Marketplace Signals. Barabba recommends relying on qualitative research "to determine meaning of signals and reasons for them" (1990, Table 2). He suggests accomplishing this through expert surveys and studies on factors related to the signals. This process is a continuous one with the frequency determined by the periodicity of significant change in the market environment. Barabba's approach gives greater meaning to this study. This final portion of the analysis results expands the objective findings by taking the topic traces and determining the meaning of those signals and possible reasons for them. Three areas received market research outside of the workshop reports to discern trends relevant to NATO ACT planning: technology, industry, and government.

4.1 Technology Trends

Findings from the latent semantic analysis and topic modelling helped shape the search parameters. From a technology perspective, three technological trends emerged as prevalent among the literature and germane to NATO ACT and the MSG workshop series on commercial technology and games

- Massive Open Online Course (MOOC)
- Mobile Learning Technologies
- Alternate Reality Games (ARG)
- Networks and Architectures

MOOCs are revolutionizing the traditional forms of education. They are an evolution in a series going back to the earlier Khan Academy with the mission of using technology to *change* education and training – not just deliver the old content over a new medium. Brick and mortar classrooms have made way for online learning. According to Attis, Koproske, and Miller (2012), MOOCs are initially expensive to setup but in the end are nearly limitless in their scalability and ability to reach vast numbers of practitioners and students. MOOCs allow the development, creation, and sharing of knowledge with worldwide connectivity to knowledgeable practitioners and other students as opposed to a duplication of knowledge often found in the confinements of a standard classroom. Meanwhile, mobile devices have joined forces with the MOOCs to deliver that content on the millions of smartphones around the globe. Avey (2011) provides five trends in delivering learning content. She highlights mobile devices like tablets allow for eLearning on the fly without ties to a desktop. This naturally is aided by other trends of crowdsourcing and data mining. Burrus (2012) notes the implications of mobile by the streaming of data, an increase in networks (both physically and among people), and a drive for new network technologies found in large data analysis enterprises.

ARGs are a growing trend using transmedia storytelling to deliver persuasive games. Players must interact with others to succeed and social networking is a key component of ARGs (Olbrish, 2011). An example given by Olbrish is to imagine you are a wine salesperson assigned to a new region with different possible customers. Your job is to best position yourself for each customer – requiring intimate understanding of not only the product but also the customers. This scenario is not far afield from the initiatives seen in many domains including modelling and simulation. The trend from the respected consulting group Gartner (2013) shows a steady progression in their Hype-Cycle when inspecting the forecasts from 2011, 2012, and 2013. The latest Hype Cycle is provided in Figure 6, highlighting trends noted in this analysis.

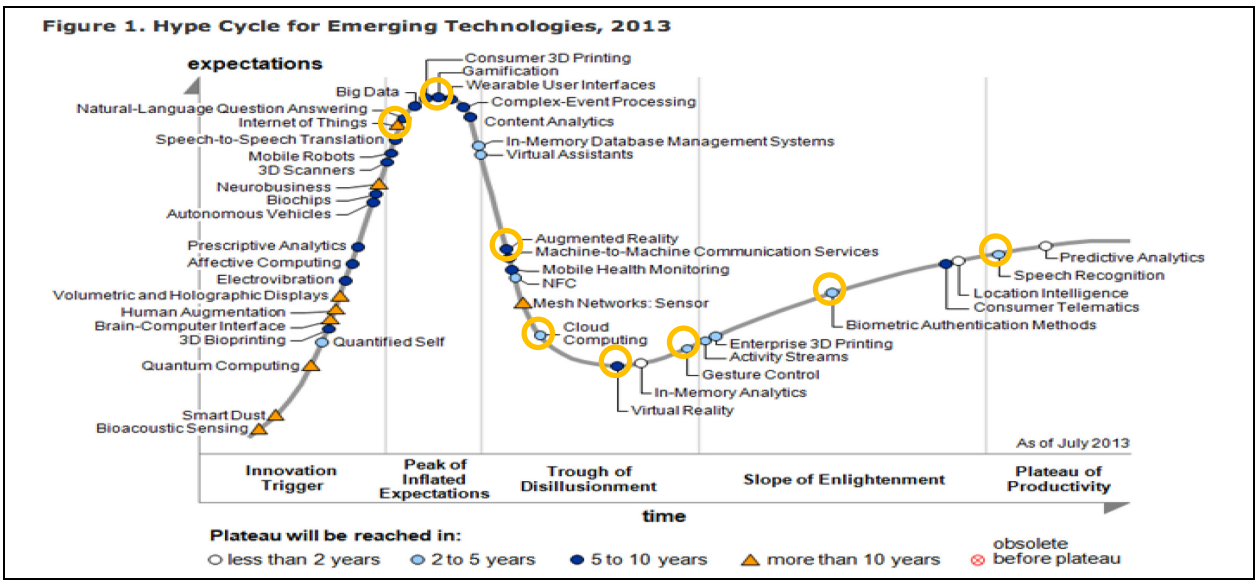

Figure 6: Gartner 2013 Hype Cycle. Technologies discussed in this analysis highlighted for reference.

Lastly, the discipline of network analysis has risen in popularity over the last two decades (Wasserman & Faust, 1999). The rise is due to the increase in social networking, increased computational power, and the understandings derived from the Internet of Things. Network analysis consists of building a network from various elements and connecting them with an underlying structure. Once constructed, basic parameters provide insights on entire systems including education and training communities. Christakis and Fowler (2007) provide a link to a short video that helps explain the value of network analysis in assessing a health issue.

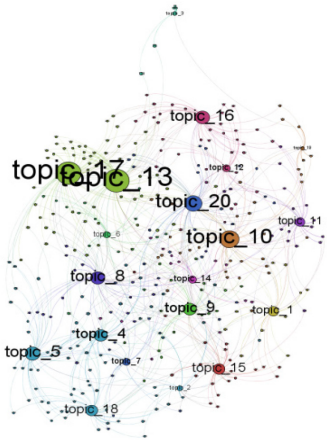

Figure 7: This network diagram comes from a journal (Electric Archaeology, 2012) and represents a network analysis to identify communities as distinguished by topics and posts in a blog space. Both LSA and network analysis techniques are viable to discern changes in the network like growth, clustering of communities or topics, and distance (associations) increases or decreases over time.

These technology trends are indicative of what is happening in the greater community of training technologies. Some of these trends are found in industry and/or in government at comparable or contrasting degrees. The implications of these technology trends relative to these two sub-communities appear in the analysis below.

4.2 Industry Trends

Although industries can radically differ from one another, one similarity is the importance of training and training technologies. Industry continues to innovate in this domain – surmounting technology constraints and pushing to find better ways to use technology or change technology to fit a better business model. Trends in discussion among industry include:

- Open Source or Proprietary
- Understanding the Needs of Government eLearning
- MOOCs as a Disrupting Technology
- Standards for Gaming

Industry is a valuable partner but must ensure the viability of investments. Good technologies for education and training exist in both open source and proprietary technologies. Industry must continue to consider alternative business models to decide how to meet the needs of its customers, including government customers. Profits and viable businesses are now possible under both approaches. Understanding the needs of government eLearning and education and training at large will be a major task to ensure proper customer segmentation, meeting customer demands, and generating the revenues from the business model selected.

Meanwhile, MOOCs have become a big business. Attis et al. (2012) pose the question, "Will MOOCs generate a positive return on investment for their providers?" They would indicate "yes" and that MOOCs are a truly disruptive technology. Two to the three big MOOC providers are for-profit entities started with venture capital. Udacity began purely as a business with venture capital backing (Efrati, 2012), whereas Coursera (also for profit) had a strong partnership with Stanford University. It has received substantial venture capital in excess of $60M (Kolowich, 2013). Predictions also point to a future of game-based learning through the MOOC architecture (Attis et al., 2012). This will continue to stimulate the question for standards in gaming. What is the desired platform(s) for virtual reality and virtual worlds? What is the impact of xAPI on SCORM? How will gesture control like the Kinect camera be integrated into government games? What protocol for speech recognition is desired, if any? Will biometric authentication be necessary, as Coursera has implemented to verify the learner's identify?

4.3 Government Trends

A study by GovDelivery (2013) notes three key trends for governments: .collaboration with other agencies and citizens, customer service, and mobility (Bring Your Own Device). These in combination with the technology trends produce a list of government trends for NATO:

- Collaboration
- Architecture for MOOCs
- Augmented Reality and Virtual Worlds

Collaboration within the organization and with partners is a key challenge in distributed learning. Synchronous techniques and the necessary architectures are burgeoning. Attis et al. (2012) pose the very serious question, "What can we learn from early entrants into large-scale online instruction?" The answer is a great deal. This is where collaboration and MOOCs may be mutually beneficial topics. Consider the United States Joint Knowledge Online (JKO). Its role is to provide eLearning, yes; but it also is intent on

collaborative learning through its Small Group Scenario Trainer. This is an example of not only collaboration in training but also a "mini" MOOC. Is this a precedent for other nations? Is it a good idea?

Harvard University and MIT formed edX and is another MOOC provider. They have no venture capital and they are a not-for-profit entity. This would give some credence to the governments and NATO looking into establishing a MOOC to enhance collaboration. On the other hand, there are many examples cited that are not a part of the JKO approach like crowd-sourced student support, an incentive to pedagogical change, and the knowledge of scaling courses up to 200,000 students or more (Attis et al., 2012). This may support a discussion on whether NATO and nations should develop or purchase MOOC architectures. These questions about MOOCs are not that different from the discussions about virtual worlds last decade and the areas of interest in ARGs. Some possible questions include:

- How does Joint Knowledge Online and NATO eLearning courses compare with MOOCs like Udacity, Coursera, edX? What can they learn from them?
- Should governments "contract" these large MOOCs to serve their audiences not unlike the use of Google Earth on classified networks that was a contract with Google and defence?
- What is the role of ARGs in the future of government gaming? What aspects of ARGs are complex concepts, which should be discussed at a workshop event?

5.0 SUMMARY OF SEMANTIC ANALYSIS RESULTS

5.1 Accomplishments

Latent Semantic Analysis. Given the nature of the data (corpus) provided, a literature review identified a capable analytic approach from the field of humanities to search for underlying trends. A modified version of this approach combined singular value decomposition techniques with topic modelling in lieu of raw word frequencies and met study needs.

Topic Modelling. A key aspect of the analytic technique of latent semantic analysis is to find patterns among words. This approach works best for comparing corpus of work among various authors. In this study, the desired patterns were in topics across workshop events. Topic modelling techniques developed for such analysis allowed for a more robust use of latent semantic analysis while preserving the benefits of that technique. Thirty topics tended to produce the best topic model and of those, 15 were used in the analysis.

Topic Clustering. Eleven topics emerged as having the greatest impact on the trends inherent in the corpus. Four additional topics were prevalent among the corpus, but were not included in the topic clustering (factor analysis) so as to reduce noise and allow topics having the interesting impact to emerge. Three distinct clusters formed:

- virtual worlds in evolution of immersive training,
- immersive military training (with five sub-clusters),
- human dimension and pedagogical effectiveness of immersive learning environments (with five sub-clusters).

Topic Definition. The latent semantic analysis and topic modelling techniques are quantitative in nature. They result in groupings and clusters, but do not interpret the contents of the clusters. The descriptors of the three primary clusters noted above resulted from a qualitative reading of all sections of the seven workshop reports having an association to the topics. Eleven descriptive phrases defining the topic keys resulted from this human treatment of the machine learning data. It is worth noting the topics were not necessarily the explicit topics of the various workshops. Rather, they were latent – underlying the sequence of presentations.

Topic Trace Graphs. The quantitative data and the qualitative topic definitions generated 11 topic traces showing the prevalence of each topic chronologically since 2009. These traces not only indicate occurrence but also enable comparison of topics over time. Some topics flowed together while results also showed some topics leading to others. Topic traces provided the means to analyse trends, make four findings, and make recommendations.

Trends in Technology, Government, and Industry. Trends from the technical evaluator reports resulting from latent semantic analysis and topic modelling were useful key terms in investigating the open literature. This led to numerous trends in technology and an analysis of the industrial and government domains as they comparatively relate to another.

5.2 Limitations

Although a great deal of insight was gathered from textual analysis of the workshop reports, this report does not presume to represent all the many views present at each of those seven meetings. The limitation is in the quality and perceptiveness of each of the reports. The insights in this study serve as a baseline for further consideration by members of NATO ACT and MSG on Exploiting Commercial Technologies and Games. The corpus (data) was also limited to reports from a single MSG – one ACT group interested in supporting NATO education and training. Other organizations (such as Joint Force Trainer) may have insights that would corroborate or refute the analysis in this study.

In terms of data, the data size was relatively small as compared to many latent semantic analyses. This study had 177 documents in the corpus with 47,828 words. One example from the literature was a study on the *Richmond Dispatch* during the years 1881 to 1865 that used 112,000 documents and nearly 24 million words (Nelson, n.d.). Although the statistical techniques do not require a large corpus, larger samples are typically more illustrative of latent trends. As a test, the author conducted a pilot test analysis using 13 documents and 2,130 words. The results provided an accurate cluster of papers grouped together for a professional conference. Lastly, the most insightful open source trend information came from Gartner, Inc. The reports available to the open public represent a small amount of the detail otherwise available to organizations having a subscription to the service. More trend insights would emerge using subscription reports.

5.3 Post Analysis Questions

During the course of the corpus exploration and analysis, team members identified a number of interesting questions, which may also be of interest to NATO:

- How would a full Latent Semantic Analysis (LSA) with a user-specified ontology differ from the modified LSA techniques using topic modelling? The desired ontology would come from a survey of NATO ACT members guided by the results of the topic modelling.
- Other factor analysis techniques like Predicting Trees can predict outcomes or associations based on data, which includes qualitative responses. How might information from this rapid study inform the generation of predicting trees to help NATO forecast trends in commercial technologies and games? (an example of a predicting tree found in the *NY Times* to predict the 2008 United States Presidential election is available at http://graphics8.nytimes.com/images/2008/04/16/us/0416-nat-subOBAMA.jpg).
- Network analysis continues to increase in use as more access to data allows analysis of systems as the networks they truly are. Would network analysis offer a different perspective that highlights management questions not currently focused upon?
- Some of the trends in technology, government, and industry came from information available through Gartner, Inc. the authors only had access to public domain reports. What additional fidelity would emerge in the trends if full access to Gartner technology reports were available?

- How might the results differ if analysis was focused on documents from across NATO ACT on eLearning, Modelling and Simulation, and the Connected Forces Initiative?
- S-curve modelling is a widely used with trend analysis to forecast the growth of phenomenon. This applies to technology forecasting as well as life sciences. What would emerge from a study using S-curve (logistic regression) models along with the nGram corpus of literature available through Google to forecast trends in immersive military training and pedagogical effectiveness of immersive learning environments? An example of S-curve modelling is shown in Appendix G.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

This MSG workshop series on commercial technologies and games have investigated trends in the area of enhanced military training and education for nearly 10 years. Seven reports dissected into 177 separate, chronological divisions served as the basis for analysing latent trends in the use of commercial technologies and games for use in NATO education and training. This report provides the analytic and investigative results for a large corpus associated with the MSG workshop series over the past four and a half years. It is a synthesis of many complementary analyses and investigations designed to characterize the corpus (data) for those involved in the development of strategies. The analysis fuses much of the isolated data from the various reports into trends and findings about the contributing factors of those trends.

6.2 Recommendations

***Finding 1*:** Scenario realism continues to improve and shows an association with the level of discussion of social media and the human dimension during workshops.

> **Recommendation**: Future events should strive to balance discussions on technological and human dimension topics by considering different use cases at each event.

***Finding 2*:** Discussions focused on solving new requirements tend to lag the introduction of the topic by three workshop events.

> **Recommendation**: Workshop planners should use an outreach /market research plan to align topic introduction with desired solution timeframe and assume an 18-month lead-time for a trend to emerge.

***Finding 3*:** Discussions focused on user experience have emerged within the workshop reports and persist in current discourse.

> **Recommendation**: Process topics seem a likely evolution from technology to people to process. Harness user experience discourse to highlight process-oriented games and training requirements.

***Finding 4*:** Assessment of training effectiveness, return on investment, and time efficiencies recently emerged as a workshop topic and this will likely continue.

> **Recommendation**: Assessment includes topics ranging from pedagogy to return on investment to time savings. Extend calls for papers on these topics for future workshops.

Appendix A – REFERENCES

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Appendix B – ANALYTIC TECHNIQUES AND TOOLS USED FOR STATISTICAL MODELLING

Factor analysis. A family of techniques to aid study phenomena having great complexity and size in order to discover patterns within the data. It supports inductive and deductive analysis and applies to both quantitative and qualitative data. Its key characteristics include: working with large datasets, showing complex interrelationships to either unite them or separate them into clusters, working *in situ,* meaning working with the data within its own context without the need for an abstract analytic framework, and being among the most widely used methods by mathematicians, statisticians, and analysts on many topics – especially the social sciences (Rummel, 1988).

Latent semantic analysis. According to Landauer, Foltz, and Laham,"Latent Semantic Analysis (LSA) is a theory and method for extracting and representing the contextual-usage meaning of words by statistical computations applied to a large corpus of text" (1988, p. 2). Characteristic of this technique is the total of all words in a corpus contains an association scheme not visible to a casual reader. LSA is capable of simulating human cognition in word-categorization and overall document comprehension. It can be used to estimate the context of the words in a corpus or to establish a computational model of the text. LSA has shown high correlations of what the method extracts and human meaning of the text. LSA is "a powerful mathematical analysis that is capable of correctly inferring much deeper relations (thus the phrase 'Latent Semantic'), and as a consequence are often much better predictors of human meaning-based judgments" (Landauer, et al., 1988, p. 4). It is from the family of factor analysis and neural network analysis has the similar characteristic that LSA garners its understanding of words solely from the text alone without the need for inputs from the physical world or intentions.

Topic modelling. Topic modelling is a technique that simplifies the analysis of large volumes of unlabelled text. It uses statistical methods to group sections and discover patterns that may otherwise go unnoticed (Nelson, n.d.). Management and researchers often desire to know the underlying (latent) structure of associations among otherwise nonrelated indicators. Is there a pattern? A single pattern? Multiple patterns? (Fabrigar & Wegener, 2012). The term latent means "a quality or state existing but not yet developed or manifest; hidden; concealed" (Latent, 2014). The MALLET tool (McCallum, 2002) took the seven workshop reports and generated a specified number of topics. Different from a pure latent semantic analysis, an ontology of terms is not fed into the tool. Rather, specific topics emerge from underlying patterns as the statistical algorithm processes the corpus (Nelson, n.d.). The tool creates topics – "a cluster of words that frequently occur together. Using contextual clues, topic models can connect words with similar meanings and distinguish between uses of words with multiple meanings" (University of Massachusetts, 2013, para. 1). The true power of topic modelling lies in working above and outside of the document level. "Topic modeling, instead, allows us to step back from individual documents and look at larger patterns among all the documents, to practice not close but distant reading, to borrow Franco Moretti's memorable phrase" (Nelson, n.d., para. 12). As Nelson points out is not a substitute for careful reading of texts, but it allows readers to get some ideas of where patterns appear across the entirety of the corpus.

Singular value decomposition. This technique is the driving force behind LSA. It is closely related to factor analysis and is a mathematical technique to decompose a large matrix into a lower order (smaller size). This form of factor analysis stems from the mathematical property that any matrix may be factor analysed. So long as there is meaningful variation among the data elements – that which manifests itself from factors other than chance – then factor analysis may uncover the patters causing the variation (Rummel, 1988). The "magic" of singular value decomposition is the "mathematical proof that any matrix can be so decomposed perfectly, using no more factors than the smallest dimension of the original matrix. One can reduce the dimensionality of the solution simply by deleting coefficients in the diagonal matrix, ordinarily starting with the smallest (Landauer, et al., 1988, p. 9). This decomposition can reduce a large set of inputs to the most important few – a great aid of deal with large bodies of text. The "R" Statistical package accomplished the

decomposition and identified those factors as well as a cluster diagram showing the associations among the topics from the topic model (R Core Team. (2013a).

Exploratory visual analysis. This technique relies primarily on creating and inspecting scatterplots from various datasets. The team used the free, open-source "R" software package (R Core Team, 2013b) to do some graphing and statistical analysis. However, all analysis is reproducible in a spreadsheet package along with the algorithms to transform the data.

Market research. Although market research is not strictly a statistical technique, it is an analytic approach used in this study. This is a familiar method and typically describes determining what the customer wants. Barabba (1990) offers an enticing alternative view to market research. He points out traditional methods often fail to provide the answers expected. He states it is often used to validate decisions already made instead of seeking alternatives. His work provides tables that form a decision framework to assist organizations "develop a balanced approach to the 'technology push/demand pull' product development process (Barabba, 1990, para. 3).

Appendix C – TOPIC GENERATION USING TOPIC MODELLING

INTRODUCTION

Text analysis classically requires word ontologies as an input to the analysis. These ontologies determine what is captured from the machine computation. This study used topic modelling to generate ontologies based on the data within the report. This approach proved effective and made the study possible. Creation of ontologies would have added weeks or even months to the study.

METHODOLOGY

The MALLET tool was fed the seven workshop reports. The only inputs required were the number of topics desired, a decision to include or eliminate stopwords (i.e., “a”, “the”, “we”, etc.), and the option to remove whitespace.

RESULTS

Topic models were generated for a range of 20, 30, and 40 topics. Visual inspection of the MALLET outputs indicated 30 topics balanced the density of content with a minimal topic count. The MALLET output showing the 30 topics and their proportion by document is provided in Annex C-1.

MALLET also generated a list of Topic Keys showing the words that compose the underlying topic within the documents. Table C-1 provides the full data set of Topic Keys.

Table C-1: Topic Keys. Word list generated by MALLET to express each of 30 topics.

ID	Importance	Topic Keys
A	1.34305	mr nato game technologies learning provided development dr system immersive buck virtual presentation education games examples commercial technical world
2	0.04586	italy genoa immersive information university bruzzone fear diptem scorm thurkettle lms april plans web united procedural miss busetta belief
3	0.09772	maritime navy things data people domain includes noted naval threats series number effects platform cmre knowledge team large case
4	0.06131	began host operator view surface james serve ships complete individual instructors consideration gambill suite details carlo boats adapted predictive
5	0.07015	close attained developing fabrizio space showing anti recording tompson scope connected instance move helicopter decade project calculations precise force
B	1.61239	games gaming discussed figure data defence focus environment environments human high play virtual gave making concept models nations approach
7	0.13862	gave worlds garcia learners aims free simulation gamification crowd johnny november digital cdr social traditional technology supervision unlimited coffee
8	0.13438	mosbe bluefor dive civilian lto big test actual fit subject simon sensurprys summation versus programme strategies back belief insurgency
9	0.08587	col profile wijngaarden gillis avatar ecs findings rome highlighted simulator window artificially fusing mrs gain enhance wars bees injuries
10	0.06575	figure norway transmedia guest server ffi players massively mmo illusion persistence member social diablo tanks motivation observer sondergaard raybourn
11	0.07915	interfaces topic fawkes morrison common chair cloud security mod commercial devices ltc garcia architecture thurkettle graphics processes talking physical
12	0.05106	engine defend tesei find la km presagis enables assessment sensor robot ecosystem fabio cyber registered bench tracking main optical

13	0.1087	virtual world worlds presented language coe roman act vbs overview called required paul culture investigation thurkettle framework center spruill
14	0.19969	colonel keerati instructional infrastructure working teach provider memory simulate involves survey enables location axis prototyped validate responses retrieval patterns
15	0.0542	day applications tracing ray workshop proprietary realism worlds licensing mod access attendance simply alternative cojack insurgent product offer investment
C	2.28035	training simulation technology support based future research work time systems armstrong level interoperability areas capability user discussion cost software
17	0.80612	vbs open game military application presentation cots world real uk ai time source end based make qinetiq realistic products
18	0.0616	weapons bruzzone platforms ship riccardo networks due tool provided screen attendees ltcdr energy zini operators digital conditions ranging unige
19	0.0664	learned group ambient improved camera infrastructure engage realistic ship simulations concern advantages master recommendations interaction interfaces vehicles months discovery
20	0.04845	transportation asymmetric reflection directing myocean reducing selex warfare limitations lies mtao predications arms dimensions foam crwt verify galileo matteo
21	0.07924	sweden brown wireless automation encourage simulated humansim defense game meta modes playing repositories insights robert suited doctrine accreditation perspective
22	0.06534	microsoft lvc exercises mobility qinetiq hire sensitive behaviors orders medical efficient rational relevance jan jerry essential effectiveness recurring buy
23	0.15516	ship multi algorithms exist mbda operation approaches organisations nations communications motion demonstrate studied difficult ten understanding gunner connector dinner
24	0.11438	user source terrains techniques bistudio wg xpi learning scenarios potential main engine fact found benefit norway roughsedge aos ways
D	1.85585	workshop games nato commercial msg technologies provide industry technology workshops military act exploiting issues group capabilities national presentations operations
26	0.16491	crespi networking united joy evolution supported trinigy dealing jittrawong automated outreach custom mash allowing simple fee initiative transportation streams
27	0.06764	companies esp afmp noted force player builder considered french op community visual produced study briefed command detail tr careful
28	0.06236	speech bosch supports pilot area years engaging put experts jtts practice animation make specifically interface cities dangerous sciarra den
29	0.13199	intention agents gamers scorm behavior savona evolving attain efficient college courses evaluate clinical mattia implement medical continuous delivery canada
30	0.07337	syndicate bruzzone leverage trends back real simonsen frank enterprise obstacle release story photo jcats symptoms swedish service recommended jim

Exploratory analysis of the 30 topics indicated four to be not useful. Table C-1 contains the list of topics by topic key ID and the keywords associated with each topic. Those labelled A through D were eliminated from the topic matrix. They were indeed overarching topics and germane to the workshops but inherent in the events as demonstrated by the abundance of terms like “workshop”, “nato”, and “mr”. Elimination of these four topic keys resulted in a matrix of 26 topics by 7 documents. This matrix served as the input for singular value decomposition analysis

CONCLUSION

The goal in generating topic models is to generate an appropriate number of topics that accounts for the density of the corpus context by spreading variation over enough topic bins. Too few results in saturation of the model while too many topics can create too many bins and a sparse matrix. The 30 topics generated in this topic model were an appropriate number to support the subsequent semantic analysis.

Annex C-1 – TOPIC MODEL BASED ON 30 TOPICS

Doc #	Doument Name	Topic 1	Weight	Topic 2	Weight	Topic 3	Weight	Topic 4	Weight	Topic 5	Weight
1	2009-May-MSG-074 Report.txt	17	0.2812	15	0.1825	24	0.1125	27	0.1038	16	0.1007
2	2009-Sep-Combined MSG-074-078.txt	25	0.7281	16	0.1487	17	0.0434	6	0.0419	1	0.0163
3	2010-Nov-MSG-093 Report.txt	13	0.3280	1	0.2044	16	0.1708	25	0.1587	9	0.0690
4	2011-Oct-MSG-108 Report.txt	25	0.1954	16	0.1880	6	0.1400	11	0.1348	1	0.1205
5	2012-Apr-MSG-113 Report.txt	1	0.1904	6	0.1629	2	0.1505	16	0.1457	25	0.1283
6	2012-Nov-MSG-114 Report.txt	1	0.2467	6	0.1594	16	0.1376	25	0.1229	10	0.1213
7	2013-Oct-MSG-130 Report.txt	16	0.1953	3	0.1581	1	0.1254	6	0.0931	18	0.0666

		Topic 6	Weight	Topic 7	Weight	Topic 8	Weight	Topic 9	Weight	Topic 10	Weight
1	2009-May-MSG-074 Report.txt	8	0.0685	6	0.0639	25	0.0484	23	0.0350	1	0.0026
2	2009-Sep-Combined MSG-074-078.txt	8	0.0161	11	0.0028	14	0.0003	26	0.0002	23	0.0002
3	2010-Nov-MSG-093 Report.txt	17	0.0588	6	0.0088	30	0.0008	14	0.0001	26	0.0001
4	2011-Oct-MSG-108 Report.txt	30	0.0628	17	0.0536	21	0.0518	22	0.0387	3	0.0040
5	2012-Apr-MSG-113 Report.txt	7	0.0620	29	0.0563	26	0.0511	14	0.0445	17	0.0063
6	2012-Nov-MSG-114 Report.txt	7	0.1119	26	0.0419	17	0.0191	14	0.0175	29	0.0146
7	2013-Oct-MSG-130 Report.txt	25	0.0622	28	0.0477	23	0.0396	4	0.0385	5	0.0382

		Topic 11	Weight	Topic 12 1	Weight	Topic 13	Weight	Topic 14	Weight	Topic 15	Weight
1	2009-May-MSG-074 Report.txt	5	0.0003	14	0.0001	26	0.0001	7	0.0000	29	0.0000
2	2009-Sep-Combined MSG-074-078.txt	7	0.0002	29	0.0002	24	0.0002	13	0.0001	3	0.0001
3	2010-Nov-MSG-093 Report.txt	23	0.0001	7	0.0001	8	0.0001	29	0.0000	24	0.0000
4	2011-Oct-MSG-108 Report.txt	9	0.0040	19	0.0024	26	0.0019	8	0.0011	29	0.0003
5	2012-Apr-MSG-113 Report.txt	13	0.0005	27	0.0005	9	0.0002	12	0.0002	23	0.0000
6	2012-Nov-MSG-114 Report.txt	12	0.0046	5	0.0010	3	0.0008	8	0.0003	21	0.0003
7	2013-Oct-MSG-130 Report.txt	19	0.0378	12	0.0365	17	0.0302	20	0.0295	24	0.0006

		Topic 16	Weight	Topic 17	Weight	Topic 18	Weight	Topic 19	Weight	Topic 20	Weight
1	2009-May-MSG-074 Report.txt	13	0.0000	3	0.0000	9	0.0000	21	0.0000	11	0.0000
2	2009-Sep-Combined MSG-074-078.txt	9	0.0001	21	0.0001	30	0.0001	5	0.0001	27	0.0001
3	2010-Nov-MSG-093 Report.txt	3	0.0000	21	0.0000	11	0.0000	5	0.0000	27	0.0000
4	2011-Oct-MSG-108 Report.txt	13	0.0003	14	0.0001	23	0.0000	7	0.0000	24	0.0000
5	2012-Apr-MSG-113 Report.txt	8	0.0000	24	0.0000	3	0.0000	21	0.0000	11	0.0000
6	2012-Nov-MSG-114 Report.txt	23	0.0000	24	0.0000	13	0.0000	9	0.0000	11	0.0000
7	2013-Oct-MSG-130 Report.txt	22	0.0004	14	0.0002	29	0.0002	26	0.0000	7	0.0000

		Topic 21	Weight	Topic 22 2	Weight	Topic 23	Weight	Topic 24	Weight	Topic 25	Weight
1	2009-May-MSG-074 Report.txt	30	0.0000	19	0.0000	10	0.0000	22	0.0000	28	0.0000
2	2009-Sep-Combined MSG-074-078.txt	19	0.0001	10	0.0001	22	0.0001	28	0.0001	18	0.0001
3	2010-Nov-MSG-093 Report.txt	19	0.0000	10	0.0000	22	0.0000	28	0.0000	18	0.0000
4	2011-Oct-MSG-108 Report.txt	5	0.0000	27	0.0000	10	0.0000	28	0.0000	18	0.0000
5	2012-Apr-MSG-113 Report.txt	30	0.0000	5	0.0000	19	0.0000	10	0.0000	22	0.0000
6	2012-Nov-MSG-114 Report.txt	30	0.0000	27	0.0000	19	0.0000	22	0.0000	28	0.0000
7	2013-Oct-MSG-130 Report.txt	8	0.0000	13	0.0000	9	0.0000	21	0.0000	11	0.0000

		Topic 26	Weight	Topic 27	Weight	Topic 28	Weight	Topic 29	Weight	Topic 30	Weight
1	2009-May-MSG-074 Report.txt	18	0.0000	4	0.0000	12	0.0000	20	0.0000	2	0.0000
2	2009-Sep-Combined MSG-074-078.txt	4	0.0001	15	0.0001	12	0.0001	20	0.0001	2	0.0001
3	2010-Nov-MSG-093 Report.txt	4	0.0000	15	0.0000	12	0.0000	20	0.0000	2	0.0000
4	2011-Oct-MSG-108 Report.txt	4	0.0000	15	0.0000	12	0.0000	20	0.0000	2	0.0000
5	2012-Apr-MSG-113 Report.txt	28	0.0000	18	0.0000	4	0.0000	15	0.0000	20	0.0000
6	2012-Nov-MSG-114 Report.txt	18	0.0000	4	0.0000	15	0.0000	20	0.0000	2	0.0000
7	2013-Oct-MSG-130 Report.txt	30	0.0000	27	0.0000	10	0.0000	15	0.0000	2	0.0000

Appendix D – CLUSTER MODEL RESULTING FROM LATENT SEMANTIC ANALYSIS (SINGULAR VALUE DECOMPOSITION APPLIED TO TOPIC MODEL)

INTRODUCTION

Cluster analysis consists of transforming a set of data in ways that allows order to arise from randomness. From this ordered transform, the proximity of elements to other elements allows clusters to generate and uncover underlying patterns. The cluster analysis for this study resulted in crisp outputs that were validated by reading and interpreting the text.

METHODOLOGY

The goal of singular value decomposition is to reduce a larger matrix into a lower order (smaller) matrix containing those variables having the greatest influence on variations and causing underlying patterns. The matrix of 26 pre-processed topics resulting from topic modelling was transformed and. Singular value decomposition (SVD) ordered this matrix into orthogonally related vectors to identify rows and columns representing factors having the most likely cause of the variation.

RESULTS

Figure D-1 depicts an image of the raw 26 x 7 matrix generated after topic modelling was complete but before any SVD was accomplished. A visual inspection of this raw data shows no clear patterns either among the rows (topics) or among the columns (documents).

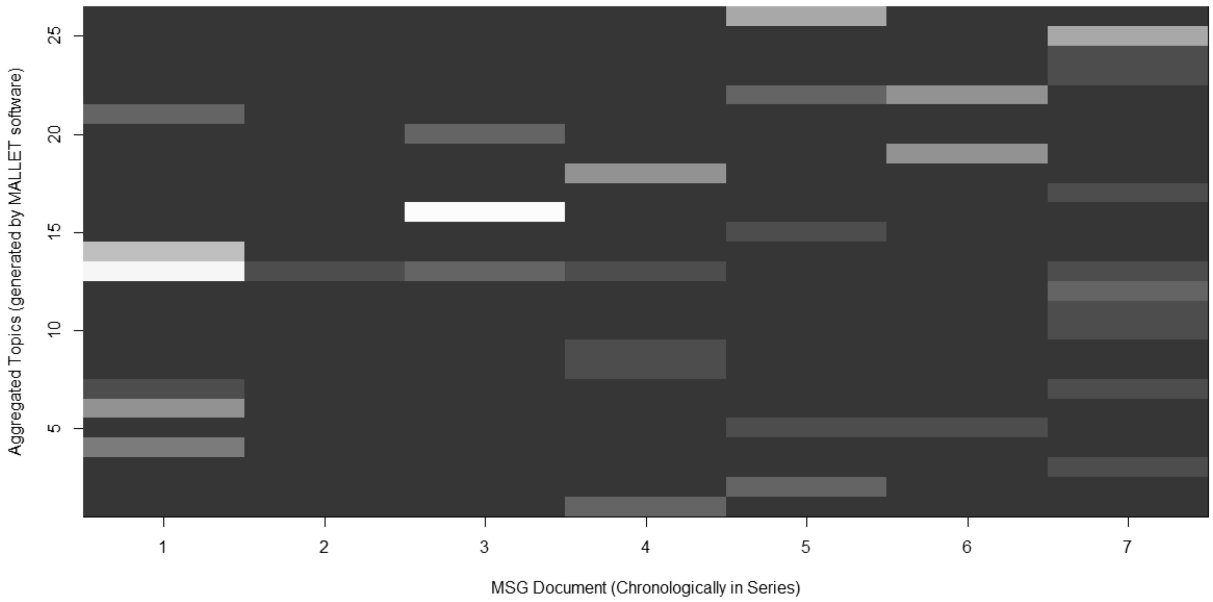


Figure D-1: Unordered Matrix. This matrix represents the Topic Model in raw form before SVD. No clear patterns are evident.

Singular value decomposition begins with ordering the matrix according to an algorithm that breaks the raw matrix into three matrices representing rows, columns, and a diagonal vector indicating scales and weights of factors. The ordered matrix – as well as the first left and first right singular vectors of the decomposed matrix – is shown in figure D-2.

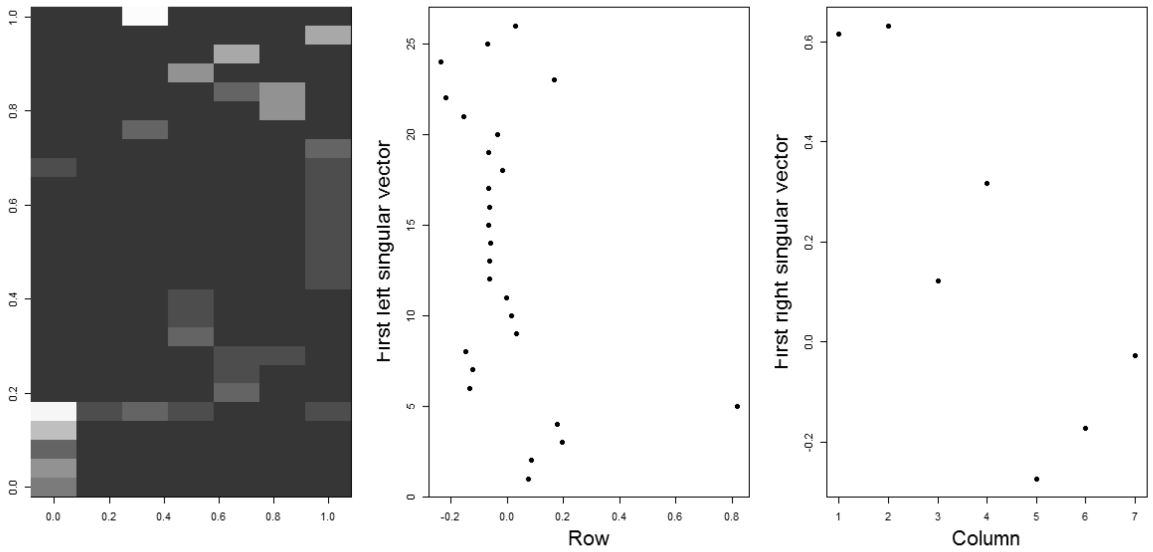


Figure D-2: Ordered Matrix. The left panel is the ordered matrix for SVD with an emerging pattern. The center and right panels show the rows and columns most likely to produce an underlying pattern.

The image in the leftmost panel now shows possible clusters amongst the colours where lighter values of grey indicate higher numerical values. The centre panel depicts the first left singular vector representing rows contributing to variation among the topics. At this point, it is not clear how many patterns underlie the data. However, it is clear that some topics contribute more variation in others. The rightmost panel shows the right singular vector corresponding to the c of the ordered matrix. These correlate to the seven workshop reports. With less data, it is more apparent that approximately four documents introduced the greatest amount of variation to the ordered matrix.

At this point cluster analysis was conducted using the hierarchical clustering method. The "R" software package performs this analysis and generates a heat map based on factor analysis and clustering techniques. Figure D-3 shows the SVD output matrix and adds dendograms to the columns and rows to indicate possible clusters of topics and documents. Figure D-4 shows both dendograms in isolation from the heatmap for readability.

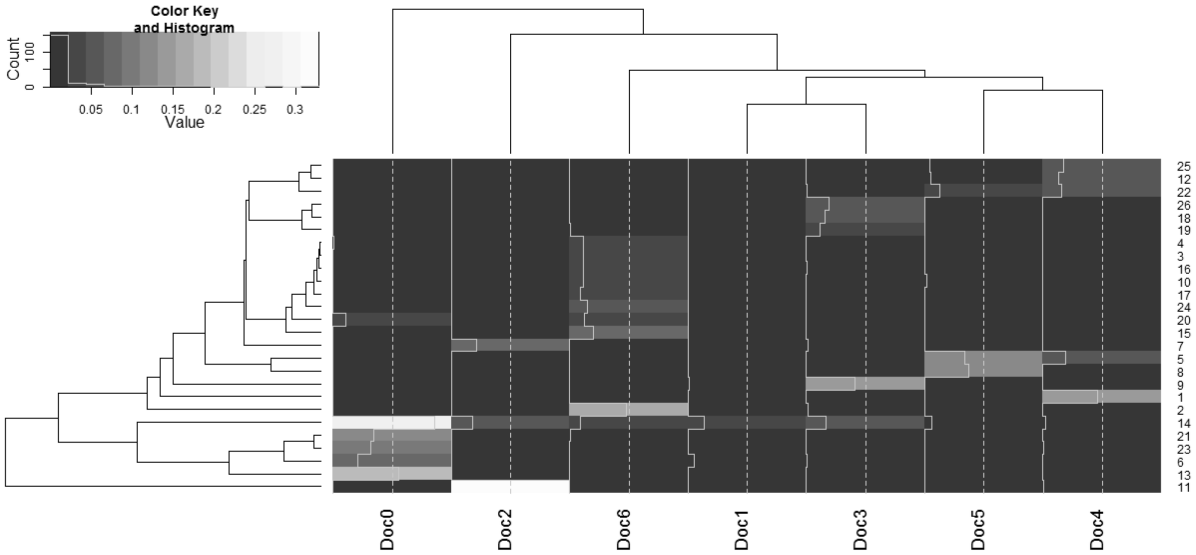


Figure D-3: Ordered Matrix Heatmap. A different presentation with dendograms showing clusters.

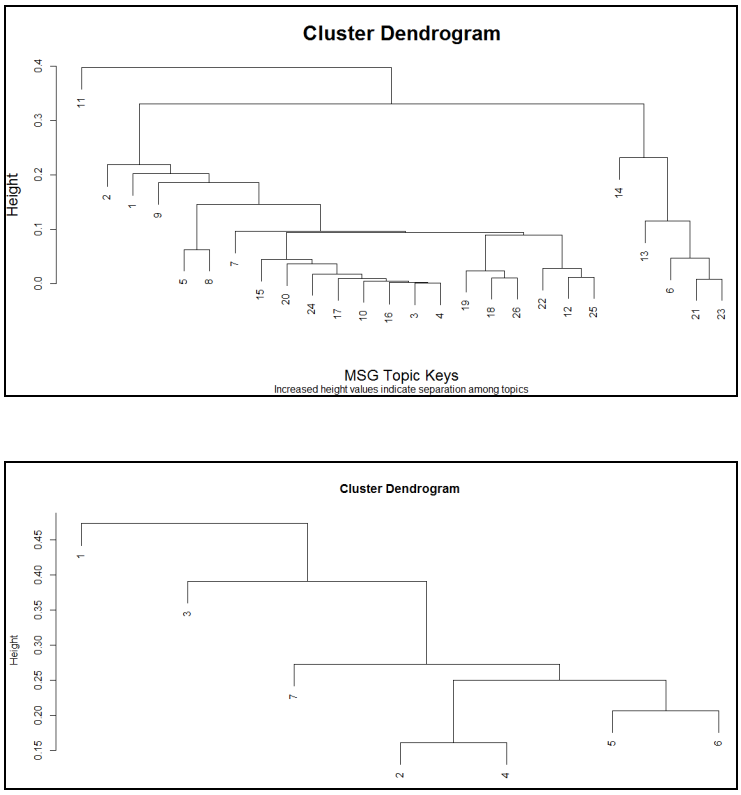


Figure D-4: Cluster Dendograms. The top panel represents topics; the lower panel represents documents.

Using the matrix generated from the topic model and formed by the SVD analysis, 11 topics were chosen by number (prior to topic definition) and were plotted versus workshop reports in chronological order. Figure D-5 shows the results of those top 11 topics. They show clear peaks over time and are large enough to be significant compared to the topics not used for analysis.

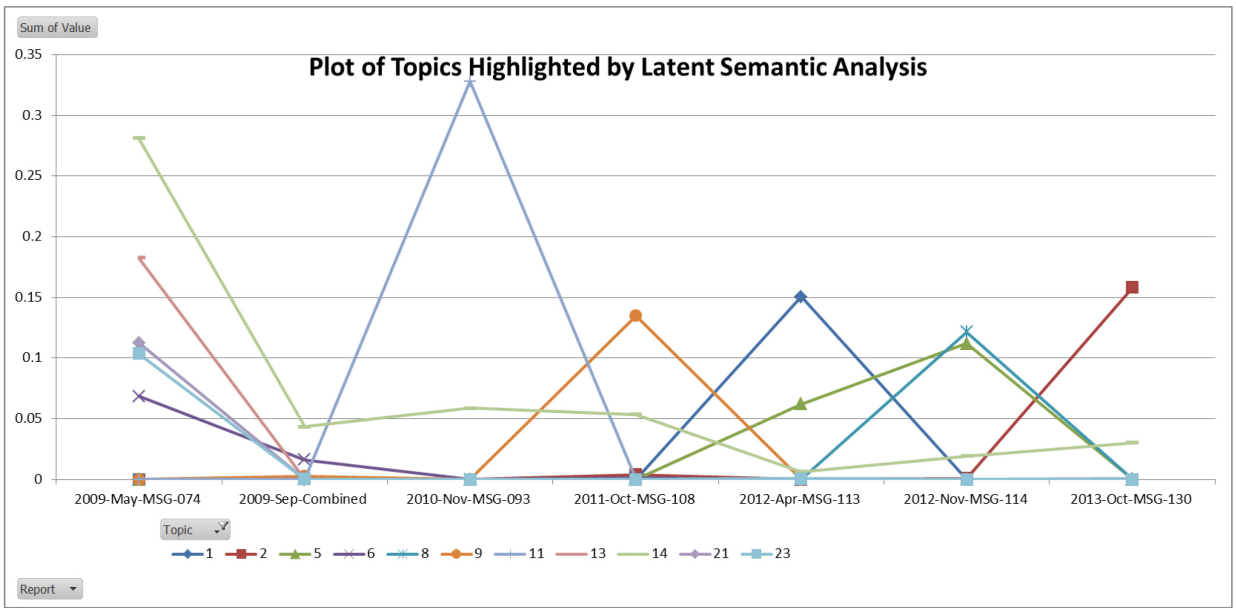


Figure D-5: Topic over Time. Interesting patterns that help validate the right topics were selected.

CONCLUSION

The cluster analysis – based on latent semantic analysis using topic modelling – resulted in a clear distinguishing of 11 topics from the original 30. These topics progressed into the topic definition phase to place meaning around the topic keys.

Appendix E – TOPIC DEFINITION

INTRODUCTION

Topic definition is a term used in this report to describe the process of transforming the list of topic keys into meaningful phrase topics. This requires human intervention but is aided by the computer to find locations where the topic keys lay in the corpus. This process enabled the definition of 11 useful and interpretable topics that enabled trend analysis.

METHODOLOGY

The most relevant topic clusters from the SVD decomposition became the input for the Voyant Document Term Frequencies software (Sinclair & Rockwell, 2014). This tool discerned raw frequency counts of each topic key word and identified which of the 177 sections of the MSG reports contained those words. Eleven documents corresponding to each of the topics from the topic model contained the relevant sections of the workshop reports for reading and interpretation.

RESULTS

At this point in the analysis, it appeared the LSA of the topics was showing underlying trends. The next step was to define the topics. Sections of the seven reports with associations to the topic keys were identified using the Voyant tool set and placed in individual documents based on topic ID for further reading. This led to an understanding of the underlying theme and each of the 11 topics was defined. Table E-1 shows the defined topics including the topic ID number and the topic key words.

Table E-1: Topic Definitions. Human interpretation of the Topic Keys based on context.

Topic ID: 1	**Topic: Immersive Learning Environments for Education and Training**
Topic Keys:	**italy,genoa,immersive,information,university,bruzzone,fear,diptem,scorm,thurkettle,lms,april,plans,web,united,procedural,miss,busetta,belief**
Topic ID: 2	Topic: Assessing Pedagogical Effectiveness of Maritime Training
Topic Keys:	**maritime,navy,things,data,people,domain,includes,noted,naval,threats,series,number,effects,platform,cmre,knowledge,team,large,case**
Topic ID: 5	Topic: Social Media Dimension of Gamification
Topic Keys:	**gave,worlds,garcia,learners,aims,free,simulation,gamification,crowd,johnny,november,digital,cdr,social,traditional,technology,supervision,unlimited,coffee**
Topic ID: 6	Topic: Future of Commercially Available Games in Military Applications
Topic Keys:	**mosbe,bluefor,dive,civilian,lto,big,test,actual,fit,subject,simon,sensurprys,summation,versus,programme,strategies,back,belief,insurgency**
Topic ID: 8	Topic: Human Dimension of Serious Games Implementation
Topic Keys:	**figure,norway,transmedia,guest,server,ffi,players,massively,mmo,illusion,persistence,member,social,diablo,tanks,motivation,observer,sondergaard,raybourn**
Topic ID: 9	Topic: Technical Dimension of Serious Games Implementation
Topic Keys:	**interfaces,topic,fawkes,morrison,common,chair,cloud,security,mod,commercial,devices,ltc,garcia,architecture,thurkettle,graphics,processes,talking,physical**
Topic ID: 11	Topic: Virtual Worlds in Evolution of Immersive Training
Topic Keys:	**virtual,world,worlds,presented,language,coe,roman,act,vbs,overview,called,required,paul,culture,investigation,thurkettle,framework,center,spruill**
Topic ID: 13	Topic: Open Source and User-Created Content
Topic Keys:	**day,applications,tracing,ray,workshop,proprietary,realism,worlds,licensing,mod,access,attendance,simply,alternative,cojack,insurgent,product,offer,investment**
Topic ID: 14	Topic: Immersive Military Training
Topic Keys:	**vbs,open,game,military,application,presentation,cots,world,real,uk,ai,time,source,end,based,make,qinetiq,realistic,products**
Topic ID: 21	Topic: Market Trends for Procurement of Military Gaming Technologies
Topic Keys:	**user,source,terrains,techniques,bistudio,wg,xpi,learning,scenarios,potential,main,engine,fact,found,benefit,norway,roughsedge,aos,ways**
Topic ID: 23	Topic: Selection Criteria in Procuring Military Gaming Technologies
Topic Keys:	**companies,esp,afmp,noted,force,player,builder,considered,french,op,community,visual,produced,study,briefed,command,detail,tr,careful**

CONCLUSION

Underlying themes emerged from the 11 documents generated by aggregating Topic Keys using the Voyant tool set. Careful reading of these documents allowed clear topics to emerge. They were used as inputs to analyse trends latent to the workshops and the technical evaluator reports.

Appendix F – TOPIC TRACE GRAPHS FOR TREND ANALYSIS AND PREDICTION

The term Topic Trace was chosen to describe the next step of the analysis based on the graphical visualizations that resulted. Trace is defined as "a visible mark, such as a footprint, made or left by the passage of a person, animal, or thing" as well as "evidence or an indication of the former presence or existence of something" (Trace, 2014). These seemed well suited for the phenomenon being represented. Figure F-1 shows a trace graph of each of the 11 topics of interest. The height indicates the raw frequency of one of the topic keys among the 177 report sections. The trace graphs are in chronological order from left to right. The dashed lines indicate the break points among the seven workshop reports.

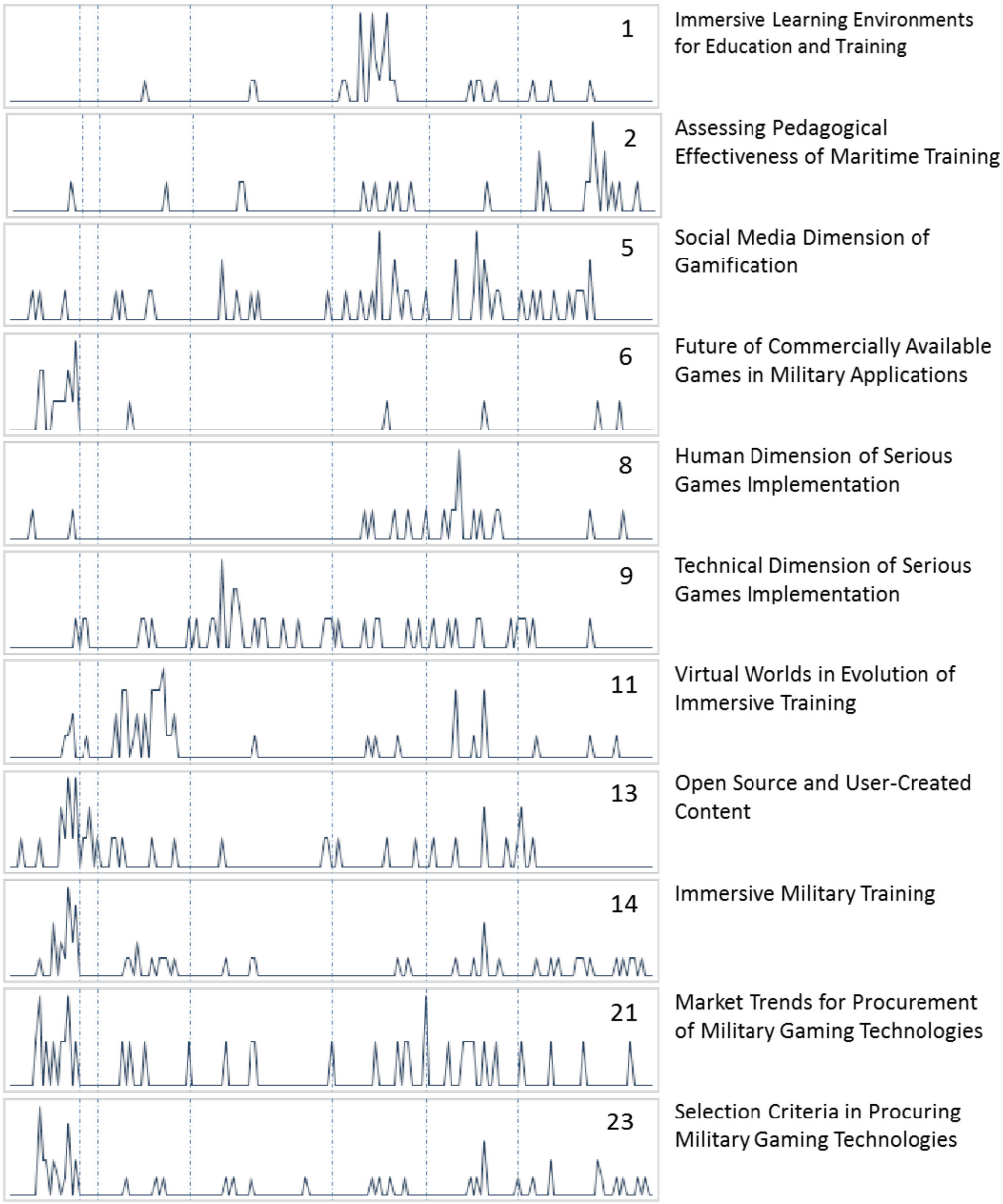
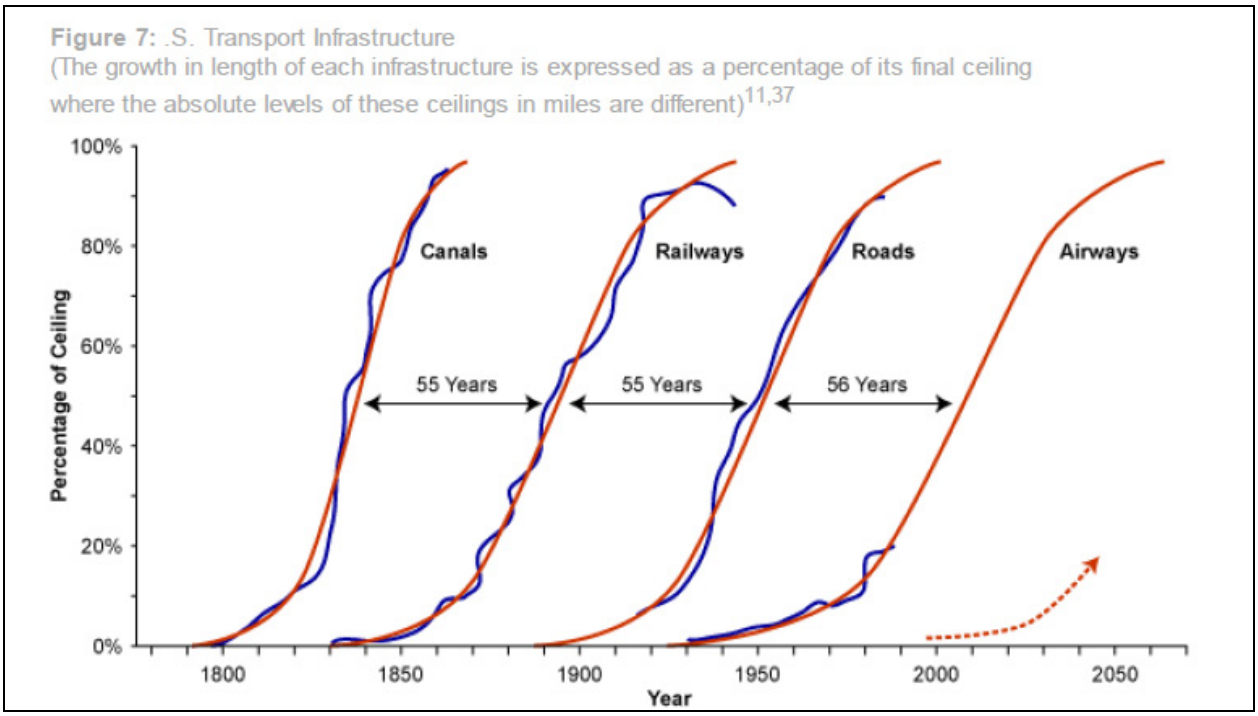


Figure F-1: Trace Graphs. Frequency of topics in chronological order among corpus.

Appendix G – S-CURVE MODELLING TO PREDICT INFRASTRUCTURE

This figure is taken from Kucharavy & De Guio (2009) in their journal article on logistical models and technology forecasting. It is presented as an excerpt from the journal as a means of an example S-curve to predict disruptive changes in technology.



Appendix H – REPORTS FROM MSG WORKSHOP SERIES ON EXPLOITING COMMERCIAL TECHNOLOGIES AND GAMES

About a decade ago, the training and modelling and simulation communities established a Modelling and Simulation Group (MSG) workshop series called "Exploiting Commercial Technologies and Games for Use in NATO" to bridge the cultural gaps through dialogue and demonstration. Twelve workshops have convened over nearly ten years. This report used reports since 2009 as the corpus for analysis. Table H-1 lists the MSG workshop series reports included in the corpus for analysis and provided in the Annex noted:

Table H-1: Analysis Corpus. MSG workshop series reports included in the analysis.

Workshop Number	Date and Location	Annex
MSG-074	May 18 – 20, 2009; Farnborough, GBR	H1
MSG-078	September 22-24, 2009; Suffolk, USA	H2
MSG-093	November 2-4, 2010; Rome, ITA	H3
MSG-108	October 25-28, 2011; Farnborough, GBR	H4
MSG-113	April 16-18, 2012; Genoa, ITA	H5
MSG-114	November 13-15, 2013; Kjeller, NOR	H6
MSG-130	October 9-11, 2013; La Spezia, ITA	H7

MSG-074 - Exploiting Commercial Games and Technology for Military Use
7th Workshop
(RTO-MP-MSG-074)

Executive Summary

Objective of the Workshop

The objective of the workshop was to provide an opportunity for the Nations working the application of commercial technologies to provide a brief update on their ongoing efforts and to provide capability briefings on the state of commercial technologies with immediate potential to provide value add across one or more of the ACT's M&S Vision document application areas (defence planning, training, operations and capabilities development). It also explored development of a common multi-national scenario for companies and organizations to participate in a distributed simulation plug-up over the internet for the follow-on workshop NMSG-078.

Conduct of the Workshop

MSG-074 was conducted 18-20 May 2009 at Qinetiq offices in Farnborough, United Kingdom. The workshop was attended by 35 invited ACT, NATO national representatives, and industry personnel participating in 15 presentations and demonstrations.

Conclusion

Based on the breadth of the presentations from both government and industry, it is clear that commercial games and associated technologies are not only applicable to military use, but already embedded in the activities of the NATO countries' militaries. Commercial games are clearly not just for training, but resident in other domains such as experimentation and analysis although training still receives the majority of the effort. Additionally, the primary underlying recurring themes were the richness of the environment and immersive qualities of games while the secondary underlying themes were non-kinetic aspects not just of the scenarios but also work that the games were supporting. MSG-074 was a leveling workshop on the individual efforts and applications of games in the military. It laid a foundation for follow on MSG workshops such as MSG-078 where in MSG-074 the participants discussed the art of the possible, and in MSG-078 the participants will be able show the art of the possible. Finally, the most important aspect of the workshop is the open collaboration ad willingness to discuss difficult issues between the national representatives and industry partners.

Technical Evaluation Report

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ABSTRACT

The 7th Workshop for Exploiting Commercial Games and Technology for Military use took place at The Portal, Qinetiq Farnborough, United Kingdom between May 18th and May 20th 2009. This report draws together the main themes raised at the Workshop. These themes included but were not limited to: Ray-Tracing as an alternative to traditional graphical rendering techniques, Open source versus Proprietary software and applications, level of detail/realism and a discussion on why more Commercial Games companies are not tempted to enter the Military Application arena.

1 INTRODUCTION

This report is not intended to be a simple summation of the eight main presentations plus national updates. Instead it is hoped that it will identify common themes amongst the differing nations, organisations and presenters. It is also hoped that where two or more conflicting view-points exist the reason for the differences, be it cultural, national, or ideological can be identified and perhaps explored in future Workshops.

1.1 Structure of the Workshop

May 18th, Day 1 of the Workshop was set aside for introductions and for attending nations to present their updates from the previous Workshop, along with a presentation from XPI/LM UK on the potential for applications of Ray-Tracing. May 19th, Day 2 contained the bulk of the content of the Workshop, the eight presentations plus an open discussion initiated by Qinetiq's Commercial-Off-The-Shelf Exploitation Unit (COTSEU) Technology Roadmap presentation. May 20th, Day 3 wrapped up the Workshop by holding an open forum discussion on the different Licensing models available to the military for the use of COTS based application, followed by a discussion on the next Workshop (to be held on September 22nd 2009, in Norfolk, Virginia).

1.2 Structure of this report

Section 2 will include a brief summary of the National Updates from Day 1 of the Workshop, but important points and issues raised here will be carried over into Section 4 where the key themes of the eight main presentations will be given (the individual presentations are available on the RTO website, this report is not intended to be a summation of their contents). The report will end with Section 5 which will cover the issues that may need to be addressed in the next and subsequent workshops.

2 NATIONAL UPDATES

Although this report will not be a simple summation of each of the presentations given during the Workshop, it is worth capturing the progress of each of the nations in a more formal manner.

2.1 Allied Command Transform (ACT) Update

ACT briefed on several programmes of work and study (NNEC and Future Capabilities) as well as:

- **Snow Leopard:** Covered the support for the NATO Training Federation (NTF) using VBS2 and demonstrated at ITEC. Snow Leopard also supports research into Virtual Worlds and supports ADL through a Second Life Island (in conjunction with the Canadians). Also supported by Snow Leopard is the concept of Shared Scenarios, the avoidance of reinventing the wheel that seems so prevalent in the Modelling and Simulation community.

- **INOPEC:** Continues to support the investigation of Modelling and Simulation comprehensive approaches to the non-kinetic areas of this field, including the (disruptive) use of Social Networking (note: the power of Social Networking i.e. Twitter and Youtube to organise protest and disseminate information is currently being displayed in post-election Iran) and the modelling of Human Behaviours. INOPEC also provides the Modelling and Simulation tools for NATO operations with regards to Kinetic Aspects (including Snow Leopard).

This brief generated a short discussion between Wg Cdr E. Roughsedge and Stuart Armstrong, Qinetiq that many potential customers for Modelling and Simulation do not know that they are potential customers. It is a case of they do not know what they do not know. Such an observation resonated with the audience but nobody could offer a succinct solution to the problem (although better education on Modelling and Simulation during early careers will help long term, it does little for the "here-and-now" where senior decision makers have little or no interest in, or understanding of, Modelling and Simulation).

2.2 Norway Update

Svein Martinussen of the Norwegian Defence Research Establishment (FFI) briefed on Norway's progress since the last meeting. Norway's use of, and study of, "Serious Games" spans much of the available market (VBS2, Steel Beasts and OLIVE) but also use of "proper" games and simulations, such as Wonderland, FSX and Battlefield2. The Norwegians have been testing VBS2 for 18 months and it is used by the Norwegian Defence Education Command, Norwegian Army Military Academy as well as the FFI itself. The Norwegians have also made use of a modified version of Unreal Tournament 2004 (UT2004) to produce NORBASE, making use of experienced military staff during the modification process. Finally, Norway hopes to do a side-by-side experiment of both OLIVE and Wonderland.

2.3 UK

Stuart Armstrong from Qinetiq (COTSEU) briefed on UK progress. Highlights of the UK update included:

- VBS2 related applications:
  - Op SOLOMON (VBS2 'lite') to be used by the British Armed Forces as an aid to recruitment
  - Op JCOVE – over 5,000 military personnel have used it for pre-deployment training
  - FRES 2 (validated data used within VBS2)

    - Counter-IED: all IED events captured for a six month period and turned into VBS2 Scenarios. COTSEU are working on a 1-day turn around from in-theatre 'event' and the production of the equivalent VBS2 scenario.
    - Federated Test Bed: VBS2, ESP, Mosbe, VR-Forces, JSAF – building lots of common terrains. All applications are working together.
- Other work involving Mosbe:
    - 'Friendly Graphical User Interface (GUI)' Investigation
    - Identified as a potential component for Joint Command And Staff Training (JCAST)
- Other applications
    - ESP: UAV Training using PRST – fly a virtual UAV in ESP and then unplug and plug-in real UAV (no re-learning of different hand-held controls – 'Train as you Fight')
    - Merlin Aircrew Tactical Trainer – rolled out to crews on-board ship
    - Coalition MMO Training using OLIVE
    - Maritime Immersive Learning Simulation (used for pre-deployment familiarisation)

The mention of ESP initiated a debate started by Wg Cdr Roughsedge who noted the seeming differences between the big primes in the 'normal' military fields and those in the 'gaming' and 'entertainment' industries. In modelling and simulation it is the small companies, such as BIStudio (VBS2) that can react to changing market conditions, whereas the big companies, such as Microsoft (ESP), unexpectedly, despite the agreement with the MOD, killed off ESP to focus on core business. A year ago, there were some within DEC JTES who believed that once Microsoft had settled on the "Serious Game" side of Modelling and Simulation it was only a matter of time before they used their weight to swallow up BIA (as it was then) and VBS2.

The Wg Cdr also raised another interesting point that featured in Days 2 and 3 of the Workshop, that of the products produced by the Open Source community, specifically that of Falcon, which the Wg Cdr described as a 'revelation'.

As VBS2 featured so heavily in Stuart's brief several attendees of the Workshop asked why the gaming community with their foray into "Serious Games" had not produced a Logistics Modelling based application. Peter Morrison of BIStudio asked a very straightforward question: "Who is defining the requirement so that gaming products can be tailored/sourced to meet the requirements?" Wg Cdr Roughsedge offered a simply reply – that there are no requirements because the Logistics community lacks the in-house skill set to define those requirements. Nobody at the Workshop could offer any additional thoughts that could end this impasse.

Another issue was raised during this brief that also featured in discussions during day two and day three of the Workshop. Using Google Earth (and the like) it is now possible to extract a basic and potentially reasonable resolution image of anywhere in the world, so why aren't there any "Whole World" terrains? Peter Morrison offered a succinct reply – Teens don't want "Whole World" terrains – they don't want dull parts of dusty Kenya. If the Military want something that is not appealing to the Game Industry's Core Market (which is where they make their profit) then they will have to invest directly in the game company for it to happen.

2.4 France

Jerome Martinet from the French Battle Lab (LTO) briefed the French progress in the use of COTS applications. Again, VBS2 featured heavily and once again, an interesting aspect of Licensing was raised (i.e. the legitimacy of 'Operation 'French' Point').

Phoenix 2007, an urban environment generator with a man-machine interface used the GOTS Sensurprys application, using Kynapse for animation and AI. While Sensurprys is an excellent application it is not easy to tailor for experimentation because of its complexity. For this reason for Phoenix 2008 the switch to a full COTS product, VBS2 was made. VBS2 was used to make detailed 3D terrains and scenarios were produced that allowed for iterative improvements. The AAR function was used to replay and understand why decisions and had been made and, for the benefit of the Workshop audience, produce a video highlighting the effects of non-Line-of-Sight weapon firing.

LTO is also experimenting with a plug-in for the iPhone which uses a webpage displaying movement buttons that allows VBS2 entities via a php server to be controlled via an ad-hoc Wi-Fi connection. It was not stated if this has yet found any practical purposes other than as a 'proof of concept'.

LTO are also investigating VBSKynapse, an alternative AI for VBS2 that will allow them to reuse their Kynapse work from Sensurprys. [It is noted by many military and civilian students who encounter VBS2 at the Defence Academy of the UK (DA-UK) that civilians are fairly 'dumb' – reacting unrealistically to being shot at (but not actually shot), bomb-blasts and explosions, etc. Teaching staff at the DA-UK continually point out that VBS2 is derived from ArmA and that the realism of 'white' AI is not high up on the list of priorities of the average online First Person Shooter (FPS) gamer.]

During the brief Jerome identified that prior to VBS2 they had been using standard games in experimentation using only the games own modification tools. To this end, they had modified Operation Flashpoint (Op FP) to produce Operation 'French' Point. This is where the issue of Licensing was raised again. As a commercial game, using Op FP in this way breaks the T&Cs of the game's licensing agreement. Peter Morrison (BIStudio) is aware of Op 'French' Point and is trying to persuade the organisation to switch the capability over to VBS2.

3 REAL-TIME RAY TRACING

Day one ended with a presentation and demo by Simon Skinner of XPI Simulation Limited, supported by Colin Stroud of Lockheed Martin UK (LMUK). The presentation discussed Synthetic Natural Environment Ray Tracing (SNERT) work that is funded by DTIC, DEC JTES in the UK. The work is trying to answer what appears to be a straightforward question: Can ray-tracing be made real-time?

SNERT appears to offer lots of potential benefits: visual and sensor images can be derived from the same scene data, it scales well for high poly count scenes and models and it is ideal for producing the increasingly requested "multi-spectral" imagery. With the polygon-count limitation lifted it would be possible to have procedurally generated scenery; trees, bushes, etc. (and these trees could have "real" attributes, such as chlorophyll content, which is important for camouflage detection using multi-spectral sensors).

Two approaches are available in hardware for the massive amount of parallelisation required before ray-tracing becomes genuinely real-time:

- Intel: use high number of cores (64) in a specialised CPU, the Larrabee, an x86 based CPU
- Nvidia: Tesla and Quadroplex – Hundreds/Thousands of much simpler cores, slight modification to the architecture found in the latest generation of gaming graphic cards.

Several programming languages and techniques are available to develop ray-tracing applications on these systems. From the Open Source community there is OpenRT (Yacort) and Manta. Alternatively, there is the proprietary approach of using Nvidia's CUDA (Compute Unified Device Architecture) and NVIRT which allows a Hybrid visualisation of classic Rasterisation approach (which Nvidia has, like AMD/ATi

invested in massively) with the emerging capability of Ray-Tracing for specific things within the scene (liquids, shiny objects etc).

The XPI/LMUK demo is programmed in CUDA and runs on two Nvidia GX280 graphic cards at a relatively low resolution (1024x768). The small geo-typical Middle-Eastern village runs at between two and ten hertz and while the shadowing, lighting and reflections are initially impressive, it is clear that this is "early days" and the visuals could be considered rather simplistic. Certainly, compared to Qinetiq's Quadroplex box which was running VBS2 spanning three (and can support four) 1600x1200 screens at screen refresh rates (c. 60Hz) using traditional rasterisation techniques it will be difficult to persuade the military customer and impossible for the gaming community to take a visual "step backwards" while ray-tracing techniques and technology matures sufficiently.

The future for real-time ray-tracing will be perhaps for highly complicated 3D models consisting of, perhaps, millions of polygons combined with the need for fast (i.e. real-time) radar signatures (after all radar is just one additional part of the EM Spectrum). Ray-Tracing could also improve the path-finding through complex terrains of AI controlled objects and entities.

It is likely that NVIRT offers the greatest immediate hope for Ray-Tracing, it keeps all of the visual detail (be it real or 'faked') that years of specialisation of hardware to deliver ever faster rasterisation, while allowing for all of the benefits of ray-tracing where it is either desired or required.

4 COMMON KEY THEMES COVERED BY DAY TWO PRESENTATIONS

While all eight of the presentations given on day two were from diverse sources it was clear that there were many commonalities. The key common themes covered by most if not all the presentations are given in the rest of this section.

4.1 Why aren't more "Games" companies interested in creating defence related products?

This question was asked, in several different forms, of and by the only two representatives of gaming companies in attendance at the Workshop, namely Breakaway Games (MOSBE) and BIStudio (VBS2). The fact that there were only two gaming companies in attendance is in itself indicative of the lack of interest in the military market by the gaming/entertainment industry.

The rather simple but concise answer is – money, a general inability for a games company to make enough profit to justify the investment. In the gaming/entertainment world an AAA game (a turn often used to describe a product with a big budget and/or expected to sell one million titles) the game producer can expect for a return of five-fold on their investment (so a $40M investment in a game generates $200M in sales). In a military/defence contract the same game producer will be contractually and legally limited to a profit of 10-20% of the value of the contract. (These figures are supported by a hypothetical games company presented by Peter Morrison)

Games companies also seem to exist in a strange no-mans-land between being thought of as too cheap to be of serious value or too expensive because "they're only games". For example, at the time of writing, a single seat license for the World Builder application of MOSBE is $50,000 plus $5,000 for the Scenario Builder and $200 per seat for the Viewer - so a World Builder, Scenario Builder and ten player stations would cost $57,000 dollars. This is not, from some perspectives, a small amount of money for something perceived by some to be "just a game". However, spending less than $60,000 dollars on an application that can be used as an entity level constructive simulation for Command Staff that can handle in excess of 2,500 entities (Battle Group sized encounters), with realistic (in appearance) intel from UAV assets

producing SAR, IR and multi-spectral imagery, compared to the price a large 'Prime' would charge (if they would supply such an application at all), the cost suddenly seems quite small. Breakaway also noted (on Day three during the Licensing discussion) that they had been offered $3M by one organisation to purchase Mosbe 'as is' rather than spending just the $125,000 required to purchase the licenses necessary for their needs. Is this simply an old fashioned attitude to a new way of doing business with a new type of defence contractor?

Finally, and this will be covered again in both the section on Open Source vs Proprietary and that of Licensing is the sudden change in costs when a COTS application changes from research and experimentation to a full blown military requirement. Valve were happy for Qinetiq's DIVE-II to be based on the COTS game Unreal Tournament 2 for no cost but for Qinetiq to license the UT2 'engine' so DIVE-II could be a stand-alone package, Valve wanted $1M, for just the game engine – no content – just the game engine. This is simply because that is what the game engine was worth to Valve, it is the single thing that makes their game in the entertainment field stand-out from the rest and therefore it is/was a valuable commodity.

4.2 Validation and Verification of applications based on COTS products

Something closely related to cost that is often used to deride COTS based applications, is that of their levels of Validation and Verification (V & V). The issue of V&V was raised in the very first presentation of the day given by Jen McNamara of Breakaway Games when she was queried over the validity of the data used to power "A force more powerful" (AFMP), a turn based strategy 'game'. It was acknowledged that the V&V of AFMP was unorthodox, but by recreating twenty historical conflicts in AFMP and letting them 'play out' it was shown that the application produced realistic and credible end-game results. It was suggested by Breakaway that V&V be sub-divided into mini-V&Vs performed by each lab that takes a Breakaway product, so that the level of confidence is built up over time. MOSBE itself offers what Breakaway calls "Jane's" Level of Detail and includes a rather simple kill model for vehicles (vehicles are either alive or killed, there are no mobility or firepower kills).

The presentation by Afzal Ali on the use of VBS2 during the FRES2 study in NITEworks continued the V&V debate. The V&V of VBS2 was continually called into question and yet it was generally accepted that such V&V issues can be managed. Peter Morrison asked who pays for the V&V that the military thinks it needs for COTS applications, since "looks right" and "good enough" is acceptable for the gaming market (who in the end are paying for the application's development via sales). Peter also pointed out that it is often easier to use real data/algorithms/mathematics if they're available to generate an effect rather than take artistic license and 'make it up'. V&V for VBS2 for the FRES2 experimentation was done by using military subject matter experts (SME) acting as scrutineers and deemed 'fit for purpose' (i.e. can that tank really designate a target with its laser at this particular range?).

Is this the difference between good enough for training purposes, i.e. plausibility; does the missile fly-out look right? Does it matter that MOSBE currently has only K-kills for its vehicles? Compared with the V&V required for Analysis purposes i.e. millisecond level timing of the precise course flown, using actual tracking algorithms, by a missile on an intercept course with an aircraft.

4.3 Open Source versus Proprietary Applications

The issue of Open Source versus Proprietary Applications raised its head on Day One of the Workshop when XPI mentioned, briefly, during their ray-tracing presentation that new ray-tracing architectures could be programmed via proprietary software such as NVIRT or by Open Source Applications such as OpenRT. Also on Day One during the UK update brief Wg Cdr Roughsedge discussed the (apparent) quality and attention to detail of the Falcon flight simulator. During Perry McDowell's presentation "Game Engines: Not just for gaming anymore", which discussed Battle Damage Assessment on behalf of

MOVES (Modelling Virtual Environments and Simulation), but also mentioned Delta-3D which is the DoD supported Open Source gaming engine which has been recently upgraded to include many of the features found in proprietary game engines, such as HDR (High Dynamic Range) Lighting and is the backbone for the Battle Damage Assessment application.

During the discussion on Day Three about Licensing the topic of Open Source and Proprietary applications came to the fore after Perry gave a long presentation on the benefits of Open Source, although this did not really get to the crux of the matter other than to stimulate the debate on the subject. It was Peter Morrison who noted that for his company Open Source (and therefore the loss of IP) would be committing financial suicide. A straightforward question was posed to the audience, that was not fully answered – how does a commercial company make a profit (in the here and now) if it spends money upfront developing a product which can be sold, but must be put into a format that will allow others to produce additional value added products based on this work and make potentially more profit for a fraction of the initial investment? Although Peter did note that even Bohemia Interactive (original developers of Operation Flashpoint) has benefitted from Open Source applications as Operation Flashpoint used ODE, an Open Source physics engine.

Irrespective of the debate in the gaming/COTS area about Open Source and Proprietary applications there is one definitive item of note – the MOD is inherently distrustful of Open Source. MOD, put simplistically, is a culture of secrecy and proprietary software, which is effectively a 'black box', the contents of which are kept secret from the user, suits this culture. Whereas, the thought of understanding/seeing exactly how the source code is built in an Open Source application immediately raises the spectre of 'security'. The Open Source community's argument of "many eyes a bug does squash" does not sit comfortably in the minds of those in defence.

4.4 Value and ease of user added/created content

One of the great benefits of VBS2 and MOSBE is the ability of the end-user, depending on their skill level, to add content to the basic set provided with the application, be it new scenarios, terrains or behaviours. While taking a slightly different approach to this concept the presentation by Graham Duncan of Caspian Learning and Simon Coulson of DCTS (User Generated Serious Games Case Study) studied this aspect in great detail.

Graham and Simon offered an alternative approach from the traditional method of application construction and user content creation. Thinking Worlds is a web-browser based application designed, initially, to meet educational needs (e-Learning) and has found it has much to offer to the training of military personnel. A selling point for Thinking Worlds is that it allows for training in smaller 'bite-sized' chunks, where the user feels they have ownership of the product and, equally importantly, the training, and can do this training wherever they have access to a suitable PC. This is, in concept, not that dissimilar from *A Force More Powerful* (AFMP) as it was designed with a very good manual and game-like GUI because, of the displaced nature of its use, there was no opportunity for Breakaway to provide support for the application. Another trait Thinking Worlds and AFMP seem to share is the concept that the trainer and/or the user have control over what they perceive/need the training outcome and objectives need to be, be it the layout of a ship in Thinking Worlds, or the over-throw of a dictatorship in AFMP.

The Caspian Learning presentation also raised another important issue related to the small defence market. While in browser-based applications Shockwave is DII (MOD classified Network) capable Flash is not. Also, in many ways, for the environment created by Thinking Worlds, Shockwave is 'better' than Flash (multiplayer, 3D, physics). However, Adobe sees the military/serious games market as inconsequential compared to their normal everyday (Flash-using) casual user. Therefore it is the military market which must adapt and learn to use what it can from the mainstream (entertainment) market, because products such as Shockwave will not, and have not, been updated just because the defence market would like them to be.

In many ways this is no different from users of VBS2 downloading Armed Assault (ArmA) assets (Vehicles and Terrains) from the gaming community (often at zero cost) and using 'as is'. This is not practical if V&V is required of this asset but this simply returns us to, and enforces, the 'fit-for-purpose' argument from earlier: Training (looks/feels right) over critical analysis (are the armour/max speed/weapon characteristics exactly right.

4.5 Realism

Starting with the XPI ray-tracing presentation on Day One the question was raised as to just what is "realistic"? And possibly more importantly, just how much realism is needed to satisfy the end-user? The drive for real-time ray-tracing is, fundamentally, to generate more realistic looking representations of the real world, be it reflections, shadows, lighting, atmospherics or particulates using 'real' physics, without many of the 'cheats' required by the rasterisation-based techniques. However, as discussed earlier, 'fit-for-purpose' should be the main driver for visual realism. It was noted by Breakaway games that in strategy based games, which invariably do not have exciting 3D graphics, an engrossing, realistic feeling scenario can and does lead to players sweating and shouting over the outcomes of their decisions. Game play, in the literal sense, is often more important. In fact it was noted by Breakaway that once a game/application becomes very realistic looking the slightest thing which is wrong is sufficient to destroy the immersion, whereas a lesser looking application if game play is engrossing will get away with more.

A good example of this is in fact VBS2. While VBS2 produces realistic shadows for astronomical bodies (sun and moon) which aid the immersion and increase the level of realism, at night, in-game lighting does not generate any shadows. This can be quite off-putting for the player once they become aware of it, whereas the original Dismounted Infantry Virtual Environment (DIVE) from Qinetiq which used the original Unreal Tournament engine produces no shadowing of any description and yet was fully engrossing despite the relative simplicity of the graphics, especially compared to current offerings.

It was also noted at the Workshop that on occasion too much realism can often destroy or make it difficult to focus on the precise training outcomes for a particular task. Training often needs to be a subset of the real world equivalent so that training has real benefit, but too much realism can often lead to the same cognitive overload that makes it difficult to train for a particular task or function in the real-world. Again, this can be summarised as the 'fitness-for-purpose' theme that ran through most of the discussions at the Workshop.

Of course, some improvements in the realism of visuals are beneficial to training tasks to avoid negative training. Both XPI's ray-tracing presentation (realistic lighting calculations) and Perry McDowell (inclusion of HDR in Delta3D gaming engine) highlighted that in the asymmetric battle, where the enemy may be literally hiding in the shadows within the urban environment, correctly rendered scenes where the OPFOR is actually difficult to identify (and therefore engage) is necessary, if this is part of the training that the application is intended to provide.

Increased realism in training, in particular that of the OPFOR, was covered, with particular emphasis on Insurgency and C-IED by two presentations, the first by Peter Morrison of BIStudio (Insurgent Mindset Training in VBS2) and the other by AOS (Autonomous Decision-Making Software – Populating VBS2 with realistic virtual actors).

The presentation by BIStudio identified that VBS2 is a highly adaptable tool in the hands of the imaginative. The end state for this training is to have soldiers who are better able to detect and therefore deter potential insurgent activity. During the training process the US Marines participate in eleven scenarios where they play the insurgent force trying to place an IED to destroy an AI controlled BLUEFOR. Having mastered the role of insurgent, the Marines then play as BLUEFOR, adopting mechanisms and applying the lessons learned that make it very difficult for OPFOR to place IEDs.

A video played to support this presentation showed a player as an insurgent placing an IED which, later in the video, destroyed a BLUEFOR convoy. It was noted that the IED carried by the player was 'unrealistically' floating in front of the player. However, this was a conscience decision and request by the USMC. The carrying/displaying of the IED was not the main training aim and therefore, it was not necessary to be realistic in the truest sense and have the IED hidden (both from BLUEFOR and the player). The training benefit was derived from "getting into the mindset of the insurgent", i.e. the placement of the IED in the optimum place to cause maximum damage and choosing the best location from which to observe and trigger the IED (and invariably escape).

The AOS presentation discussed a closely related matter both in terms of realism and that of insurgency behaviour, i.e. the applications Artificial Intelligence (AI). It has been noted elsewhere that exposure to VBS2 in the domain of education has lead to criticism of the in-built AI for the control/behaviour of civilian clutter. Much of this can be overcome by careful scripting, but careful scripting may require a level of skill not possessed by the end user or require time that is not available to fine-tune. The AOS solution is to offer CoJACK to control the behaviour of particular AI assets (i.e. suicide bombers). CoJACK offers an alternative to standard 'dumb' AI or lengthy scripting, by controlling the virtual actors using a BDI (Belief, Desires, Intentions) methodology. Like the LTO's control of VBS2 entities via web-based controls on an iPhone, CoJACK interfaces to VBS2 via the Application Scripting Interface (ASI) this time enhancing the control of the AI. CoJACK is designed to update behaviour on discrete VBS2 events, this is in fact the screen refresh rate plus additional in-game triggers.

The integration of CoJACK into VBS2 has some issues: VBS2 will, on occasion, use its own AI to take control of the virtual actor and can sometimes be unresponsive to CoJACK commands. Despite issues with its own internal AI, BIStudios has no wish to replace the current AI with only one alternative, it would prefer to work in partnership with as many industry (and Open Source?) AI builders as possible so that the end user of VBS2 can pick and chose additional AIs as they are required, rather than force a particular option upon them.

4.6 The future of COTS in the military domain

At some point in the relatively near future decision makers within the military will not be of the mind-set "if you're not getting wet, it's not training" or "we never needed computers when I was younger". Also, it can be assumed that new recruits will be familiar with PC based applications, virtual worlds, social networking, indeed they may very well expect the military to be in advance of what they have access to in their previous civilian lives. Will they be disappointed? Are we ready for the culture shift when it arrives?

Matt Spruill from SAIC (presentation: 'SAIC's foray into virtual worlds') raised some interesting points to end Day Two of the Workshop. Should we be focussing on the "sixth graders" (11-year olds) of today and trying to understand how they learn and with what, because given military project lead times, these sixth-graders are the eighteen year old recruits of our immediate future. Are we being "outside the box" enough to cope with a generation (the first generation) that has (theoretically) always had access to a PC and the Internet. Indeed, referring back to the very beginning of this report, this enlightenment may have already started as can be seen from the days immediately after the disputed Iranian Election 2009. It is worth noting that half of Iran's population is under the age of 25 and despite Government Firewalls blocking access to BBC Persia and other Western media services, the use of mobile phones, Twitter, Youtube, anti-filtering techniques and email guaranteed that evidence of the upheaval within Iran was getting out to the rest of the world. The disruptive force of Social Networking has never been so abundantly clear. So what will a generation who haven't just adopted and embraced such technology, but have grown up knowing nothing else be capable of in a few years time?

SAIC presented a test case for training for IEDs at the staff level. A group of 12 split randomly into those using traditional powerpoint techniques and those placed in a virtual world (US Nexus). In a pre-training

test the group that would undergo traditional training scored 20% higher marks. Post training tests indicated that the group undertaking the training in the virtual world scored 20% higher marks. While the validity of the test was questioned during the brief, what is important to note is that training within a virtual world is now not only possible, but is an acceptable alternative. In the future it may be more than acceptable, it may be expected or necessary. Given the ever increasing constraints on budgets and the ability of natural resources to support travel and or training, virtual worlds may offer one of the few opportunities for collaborative meetings, training and exercises.

Stuart Armstrong's Qinetiq Technology Roadmap for the future up to 2020 was fascinating, especially when you consider the technology roadmap for Intel extends only three years into the future and for Nvidia only nine months. Concepts such as 'cloud computing' will in the fullness of time be seen as either foolishly optimistic or foolishly short-sighted.

The UK Government's recent announcement that everybody in the UK should have access to a minimum of 2Mbit/s Internet access, shows a very narrow view of the future of Internet usage. 2Mbit/s is sufficient to stream standard definition television content. However, this will not cope with HD-TV, nor will it allow for serious levels of upload rates as the minimum bandwidth for upload does not appear to be defined within the "Digital Britain" document, so the dream of some, to rely totally on the likes of Google docs to store their digital lives might not come to fruition in the foreseeable future. The Digital Britain report does come up with one particularly interesting number – that one-third of the World's population (2 Billion people) currently have some access to the Internet.

5 THOUGHTS FOR NEXT MSG-078 MEETING

A discussion on what should be considered for the meeting in Norfolk, VA on September 22nd 2009 ended Day Three and the Workshop. Attendees would like to see the following areas discussed or considered for discussion at this meeting.

- Procurement strategies related to COTS products of other member nations (best practice?)
  - To also cover licensing strategies (if any)
- More Demonstrations
  - Possibly informal during an evening reception
- More Games Companies in attendance
  - Given the geographical location of the next meeting this more likely but:
    - Games companies are not interested in supporting, or offering military applications, Kudos is not enough, it's about potential profit
- More on Algorithms
  - For example a follow-up on the progress of the Ray-Tracing presentation given at this workshop
- Given that only a limited number of Europeans will be in attendance because of the location consider streaming Demonstrations and Presentations for the Workshop back to the UK (for example to The Boeing/Qinetiq Portal):
  - Use it as a 'proof of concept'
  - Walk-the-walk, as well as 'talk-the-talk'
  - Start working on security issues and time differentials now, so that it runs smoothly on the day

    - Sell it to superiors and get them involved and/or in attendance
    - Perhaps run an 'Exercise' of some description as part of this link
- Data rights
    - Standards and Data formats
- Middleware Plug-ins
    - Such as AI plug-ins for VBS2
- Successful Case Studies!
    - "Solutions not problems" such as the success of the USMC C-IED programme in VBS2
    - Show Leadership the successes increases chance of future buy-in
    - Representative from USMC to talk about this programme
- Re-use and Interoperability
- Human Factor based Experimentation
- More Academia involvement
    - Students, a rich source of experimenters and guinea pigs!
- How to "advertise" these events – more of the right people in attendance
- Interaction between applications
    - Is there a viable COTS alternative to DIS and/or HLA?
- More Games for non-kinetic domains
- If money was available:
    - The creation of a scenario for MSG-078
    - Ship to European participants not in attendance
    - Participate in demonstration
- Virtual Reality
    - Is there anything beyond Second Life?
- "mash-ups"
    - Moving beyond "one size fits all"

It is a long list and should simply be considered a wish list of the attendees. However, it should be taken as a good sign that interest in this area is not waning despite the belief from some that no actual advancements are achieved and attitudes from the decision makers do not change.

6 SUMMARY AND CONCLUSIONS

VBS2 was undoubtedly the single biggest focus of this workshop, featuring in some way in almost every presentation or discussion which followed. In many ways it remains the pinnacle of success for the implementation and adoption of COTS based technology into the defence arena. However, this was purely down to luck, the adoption both by the USMC and UK MOD was not done through careful selection, but simply by BIStudios being in the right place at the right time.

Are there other products and applications out there that would be ideal for adoption/conversion to military use that have simply not been lucky? Even if such products exist is there the mechanism available or the stomach to make such procurement, as that undertaken to obtain the VBS2 Gold License?

Will there ever be a time where high level decision makers expect COTS applications to be considered on an equal footing with the 'big primes'? Although the investment in ESP by the UK MOD, which seemed like a forward looking plan and a 'safe bet' may have given some of those decision-makers reason to sustain their doubts over the COTS market.

Licensing of COTS products will continue to be a topic of discussion and it will be interesting to see how the pricing of MOSBE (especially for the World Builder) affects take-up (within the UK MOD). Given the interest in the product by NITEworks and Cranfield University (in the UK) the results in the study of MOSBE by Dstl will prove to be interesting.

Intermixed with the discussion over licensing costs is the continuing issue over proprietary over open source. While open source has its merits (cost not necessarily being one of them – given the potential cost of support) it is likely that, in the military context, certainly in the UK, that the feeling of security (real or false) that proprietary software offers means that open source is unlikely to be readily adopted in the foreseeable future. Such a predication, of course, is subject to future budgetary constraints.

John Hoggard

June 2009

MSG-078 - Exploiting Commercial Games and Technology for Military Use
8th Workshop
(RTO-MP-MSG-078)

Executive Summary

Objective of the Workshop

The aim of the workshop is to explore through demonstrations and presentations the "hard questions" related to exploiting commercial games and technology in NATO. The objective of the workshop was to provide an opportunity for the Nations working the application of commercial technologies to provide a brief update on their ongoing efforts and to provide capability briefings on the state of commercial technologies with immediate potential to provide value add across one or more of the ACT's M&S Vision document application areas (defence planning, training, operations, capabilities development, and in particular SNOW LEOPARD). The objective was also to provide a common multi-national scenario for companies and organizations to participate in a distributed simulation plug-up, to provide a means for participation via teleconferencing or some other means for those not able to attend in person, and to allow ACT senior staff to observe and participate in the demonstrations.

Conduct of the Workshop

MSG-078 was conducted 22-24 September 2009 at the Virginia Modelling, Analysis, and Simulation Center in Suffolk, Virginia. The workshop was attended by 68 invited ACT, NATO national representatives, and industry personnel participating in 21 presentations and demonstrations concluding in an open panel discussion of high interest topics. The workshop was distributed via video teleconference and through the Second Life Virtual World for remote participants.

Conclusion

With the aim of the workshop to provide a venue to explore through demonstrations and presentations the "hard questions" related to exploiting commercial games and technology, to provide updates on the nations' current application of commercial technologies, and to provide capability briefings and demonstrations of commercial technologies with immediate potential for use in a distributed manner through VTC, virtual worlds or other means then the workshop was a success. The only objective not met was to conduct a plug-up using a common multi-national scenario. Most of the hard questions, while asked throughout the workshop, were highlighted during the open panel discussion at the end. The open panel discussion was one of the most beneficial portions of the workshop as it provided the mechanism for the participants to begin to shape the "hard questions" into manageable topics for further discussion at future workshops.

It is clear that NATO nations are currently using commercial games and technologies, and based on the remarks from the group, there is a need and a desire to continue to pursue commercial games and technology solutions even given current procurement guidelines. NATO and ACT have the organizational infrastructure to facilitate these types of workshops and should continue them.

Technical Evaluation Report

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1.0 PURPOSE

The purpose of this summary of proceedings is to document the NATO Modelling & Simulation Group (NMSG) MSG-078 Workshop on Exploiting Commercial Games and Technology for Military Use.

2.0 OBJECTIVE OF THE WORKSHOP

The aim of the workshop is to explore through demonstrations and presentations the "hard questions" related to exploiting commercial games and technology in NATO. The objective of the workshop was to provide an opportunity for the Nations working the application of commercial technologies to provide a brief update on their ongoing efforts and to provide capability briefings on the state of commercial technologies with immediate potential to provide value add across one or more of the ACT's M&S Vision document application areas (defence planning, training, operations, capabilities development, and in particular SNOW LEOPARD). The objective was also to provide a common multi-national scenario for companies and organizations to participate in a distributed simulation plug-up, to provide a means for participation via teleconferencing or some other means for those not able to attend in person, and to allow ACT senior staff to observe and participate in the demonstrations.

3.0 WORKSHOP AGENDA

Tuesday 22 Sep 2009

0845 – Welcome
0900 – Opening Remarks
0945 – "A Future for Simulation"
1040 – "Games for Training? Surely You Can't Be Serious!"
1120 – "VBS2 in 2010"
1310 – "Tactical Language and Culture language Training Systems"
1350 – "Joint Operating Environment (JOE) Second Life Virtual World Development"
1430 – "Beyond the Game – Embedded Training Cultures"
1530 – "GaMeTT"
1610 – "NATO MSG-078 Plugup: The Story Behind My Failure"

Wednesday 23 Sep 2009

0845 – Day 1 Recap
0900 – "What's Changing: My Perceptions and History of Simulations"

0940 – "UK MOD Serious Games Research – Looking to the Future"
1040 – "Commercial Gaming in the Canadian Forces"
1120 – "Dangerous Waters"
1310 – "NATO VBS2"
1350 – "Breakaway Demonstration"
1430 – "JCATS with a Virtual Desktop"
1530 – "VBS2 Modules"
1610 – "Multi-level, Multi-Resolution Gaming"
1640 – "Damage Control Demonstration"
1700 – Day 2 Recap

Thursday 24 Sep 2009

0900 – "Energy Gaming and Governance Impact of Tangibles and Intangibles"
0940 – Open Panel Discussion
1130 – Workshop Wrap Up

4.0 PARTICIPANTS

Dr Adrian Gheorghe	Johannes Denijs	Capt Enrico Bonatesta
Stu Armstrong	Wayne Buck	Jim Flaherty
Glen Bethel	Maj Gary Evans	Jim Carr
Mark Phillips	Marcus Dahlberg	Jan Ward
Jackie Scolaro	MG Skare	Staffan Granberg
Daniel Scolaro	Nico Bau	Robert Virding
Matt Spruill	Roger Schane	LTC Vincenzo Calicchio
LTC Chris Hall	Roy McNee	LTC Jan Beaumont
David Fliesen	Johannes Denijs	Major Jeremy MacDonald
Pete Schrider	LTC Christian Bell	Clark Rich
Patrick Samama	LTC Eriks Naglis	David Unrau
Mike Gracewood	Maj Richard Nowinski	Curtiss Murphy
Jennifer McNamara	LTC JP Cormier	Dan Henkel
Garth Jensen	LTC Istvan Ocskay	Colin Bigg
Peter Morrison	Murray Taylor	Jacek Sumislawski
Stacy Elliott	Eric Pouliquen	Walter Hader
Michael Emonts	CAPT Carlos Alberto Belinchon Pinedo	Maj Kuido Pettai
Julien Mallet	Gianluca De Leo	Jens Malmquist
Amy Grom	Col Andrea Solymar	Geoff Johnston
Doug Whatley	Dan Berry	LTC Mike Patchett
Bharat Patel	RADM Christian Canova	Maj Geoff Smith
Andrew Brown	Nathan Carreiro	Joe Armstrong
MSGT Cleon Skeete	Jaymie Caplen	

5.0 EXECUTIVE SUMMARY OF PRESENTATIONS

5.1 Opening remarks by RAdm Christian Canova and Dr. Eric Pouliquen, ACT

RAdm Canova formally opened the conference with a context presentation that explained the relationships of NATO and ACT, and how the Research and Technology Organization (RTO) fits into the organization. RAdm Canova explained that NATO ACT's mission is to be NATO's leading agent for change, driving, facilitating and advocating continuous capability improvements in order to enhance the military effectiveness and relevance of the Alliance. He also diagramed the relationship of the NATO M&S Stakeholder organizations into the requirements organizations grouped into ACT and ACO, wrapped by the support and coordination M&S stakeholders such as NC3A, then those in a consultation role such as academia, industry, and the partner nations. RAdm Canova explained the NATO R&T Organization (RTO) and its mission to conduct and promote co-operative defense research and information exchange within NATO and its partners. He explained that the RTB assigns work issues to one of seven groups within the organization that all of the partner nations have representation within. This conference, MSG-078, fits in under the Modelling and Simulation Group. RAdm Canova concluded with recognizing the need to incorporate the M&S technological advances to develop NATO capabilities, and envisaged plenty of potential, not only in the military-purpose built, but also in non-military commercial technologies and applications, such as computer gaming (serious games), collaborative work environments and social networking technologies (virtual worlds).

RAdm Canova was followed by Dr. Eric Pouliquen who focused his brief on how the MSG-078 fits into ACT and its vision. His organization, the R&T Coordination Branch, is to influence and contribute to efforts in the NATO R&T community, exploit the outputs from the R&T community, industry and academia for ACT capability development, and to lead/support capability development projects/studies such as Snow Leopard. Their current priorities are implementation of the Framework for Collaborative Interaction (FFCI) and implementation of an M&S vision. The ACT M&S Vision is ACT exploits modelling and simulation to support NATO transformation wherever it can enhance capability, increase interoperability, save resources or reduce risk in the application areas of training, operations, defence planning and capability development. Dr. Pouliquen explained how the Application Areas of M&S (Defence Planning, Operations, Training, and Capability Development) relate to the Cross-Application M&S Objectives (M&S Policy, Education, Coordination and Outreach; M&S Interoperability and reuse; M&S Common Services; Develop and Employ M&S Federations; Incorporate M&S Technical Advances) to meet the goals of enhanced capability, increased interoperability, saving resources, and reducing risk. Current work includes: technology watch, standards, outreach, models, distribution systems, and best practices.

5.2 A Future for Simulation by Doug Whatley, BreakAway Ltd.

Mr. Doug Whatley, CEO BreakAway Games, offered his vision as a future for simulation and stated that his purpose was to set the tone for the conference. His vision is "A simulation for everyone for every purpose." His premise is that in the future people will use simulation as part of their normal daily life – to think about new concepts, plan their day, study plans, and many other normal uses. As background he used an example of the Soap Factory manager that asked his staff some hard questions. In return he received answers but not the answer to his question. What was really needed was a sandbox for the manager to "play" with his ideas. Thus, when Mr. Whatley states a simulation for everyone, he means that normal people can use tools to answer their questions, tools that make all tasks simpler and more efficient, and being able to understand 2nd and 3rd order effects of decisions. In order to explore this vision, Mr. Whatley introduced the topic of organizational change. He used the typing pool vignette to discuss how organizations changed with changing technology and that the typing pool was necessary but more efficiency and quality of work drove the need for

systems to allow the "creative class." The creative class is defined as those individuals which engage in complex problem solving that involves a great deal of independent judgment and requires high levels of education or human capital. Mr. Whatley posed a series of thought provoking questions on whether or not the current developers of technology as well as the organizations are satisfying the needs of the creative class to further their individual causes or passions. He then asked if the developers of technology, and in particular simulations/games, are meeting the needs of the creative class or are they holding them back. The real question he posed to the group was whether or not we were building simulations and organizations that won't exist next year much like the typing pool. Mr. Whatley then gave a few examples of simulations for everyone such as the GPS and cleaning robots. He concluded with asking the group to identify the creative class in NATO and what will be there simulations needs.

5.3 Games for Training? Surely You Can't Be Serious! By Mark Phillips, MASA Group

Mr. Mark Phillips began his presentation with an overview of MASA Group and the company's three main areas of focus: cognitive AI, machine leaning, and optimization. He then provided a tutorial on the differences of games and simulations. He clearly stated that all games are simulations but not all simulations are games. He also espoused that as games move closer to the M&S community, they must pay particular attention to validation and verification, a lesson that MASA Group has learned by a requirement to validate 2000 behaviors for the SCIPIO program. Mr. Phillips provided a survey of what's new in the M&S community from a trend basis. He stated that more and more games and game technologies are being accepted as equal or superior to existing, large training systems or simulations; that governments are taking a hard look at overall costs and are adapting their procurement processes to gain efficiencies while still providing adequate training; and that long term development cycles greater than twelve months are simply not acceptable. He then articulated the current state and provided an argument for the use of middleware in the M&S/games industry. With speed to market in imperative, and the need to reduce the risk of system development as quick turn product lifecycles, middleware is proving to be the enabler allowing the gaming industry success. He provided a host of examples for all aspects of gaming technology development where middleware is being successfully utilized. On where we as a community are headed, Mr. Phillips believes that the pendulum is swinging from the adoption of game titles as training devices to the adoption of game middleware, motion tools, path engines, sound engines, etc will be brought together in compelling ways to build new devices.

5.4 VBS2 in 2010 by Pete Morrison, Bohemia Interactive Simulation

Mr. Pete Morrison provided a history of VBS2, the current efforts BIS is developing for VBS2, and a technology roadmap for the future of VBS2. Mr. Morrison stated the initial requirements of VBS were tactical training and mission rehearsal, combined arms training, a high fidelity environment through graphics, and an extendable system. He also stated the VBS has morphed from a pure game to more of a simulation because end users demanded scenario authoring and runtime authoring, the need for an AAR system, interoperability, and rapid terrain development. Bohemia's current efforts with VBS2 version 1.3 include: adding equipment to current kits such as fording equipment, adding additional ISR capabilities, adding robots, conducting casualty evacuation, helicopter rotor wash, shattering of HMMWV windows, the ability to create forms, and the introduction of middleware, as well as a complete developer suite of tools. Bohemia's effort with the US Army is to build 20 scenarios off the shelf as well as a VBS2 lite. Within the FITE JCTD, they are working on cultural gestures, glint for optics, realistic variation of character sizing (thin vs heavier weight people), and expanded AAR capabilities. In the VBS2 version 1.4, BIS's roadmap includes amphibious operations, improved vehicle and unit damage modeling, climbing ladders, in-game terrain editing, and situational awareness improvements. Their mission rehearsal roadmap includes Falcon View integration, first

person combat enhancements, and helicopter flight model fixes such as fast roping and landing. BIS has a plan to accomplish streaming terrain to meet the US Army large playbox requirements. They will accomplish this in three phases. On his wishlist is an image generation capability combing streaming terrain plus robust AI plus mutli-channel imaging, improved procedural terrain generation, and improved armor simulations.

5.5 Tactical Language and Culture language Training Systems by Micheal Emonts, Alelo TLT, LLC.

Mr. Micheal Emonts provided an overview of Alelo TLT, LLC and its products. Alelo's mission is, "Our revolutionary software solutions produce effective inter-personal communicators across languages and cultures worldwide." Mr. Emonts provided an overview of Alelo's history, awards, current company demographics and the value of operating in Los Angeles, California. Their key features of their products are: learner relevant tasks and missions, virtual world environments, continuous feedback, success (in context) is immediately evident, and engaging and entertaining. These features lead to motivation and motivation leads to increased training effectiveness and increased time-on-task. Alelo's current products include: Dari, Pashto, Iraqi, French, and Indonesian Tactical Language and Culture Systems (TLCTS) along with their IPod and IPhone companions; Virtual Cultural Awareness Trainer: Horn of Africa; Virtual Role Players (VRP): VBS2; GoEnglish: China and Iran; Unit Training Manager; and Operational Language and Culture Training System (OLCTS). Emerging technologies from Alelo include: Integrated System for Language Education and Training (ISLET), SocialSim-MR, and HSCB CultureCom.

5.6 Joint Operating Environment (JOE) Second Life Virtual World Development by David Fliesen, Sonalysts, Inc.

Mr. David Fliesen provided an in depth overview and demonstration of JFCOM's work in developing a virtual world. The U.S. Joint Forces Command's Joint Futures Group (J-59) is developing a Community of Interest (COI) inside the virtual world Second Life to educate, collaborate, and harmonize the Joint Operating Environment (JOE) with Non-Government Organizations (NGOs), International Organizations, and other communities. Their virtual world work includes: the JOE GeoDome, trends and context, a Sun Tsu Virtual Guide, and virtual world open solutions. GeoDome was created to further the messages and research of the JOE. The GeoDome displays the trends and contexts mentioned in the JOE. The Virtual Guide: Sun Tsu is an artificially intelligent avatar that is realistic to visitors to the GeoDome in chat sessions. The Open Virtual Collaboration Environment (OpenVCE) offers free buildings, landscaping, and textures for collaborative facilities in virtual worlds. Included in the open platform are: social networking, Drupal based content management system, and Second Life/Opensim virtual world platforms.

5.7 Beyond the Game – Embedded Training Cultures by Glen Bethel, Australian Army

Mr. Glen Bethel provided an overview of the history, perceptions and future plans of the Australian Army in the use of games and gaming technologies. The Australian Army adopted VBS1 based on the initiative of a few key military personnel. It was seen as a leap of faith and met resistance by traditional "training experts." Australia pushed forward with the project, and with the introduction of related products such as Steel Beasts Professional and Tactical Iraqi TacOps, a culture change began with the slow improving and understanding of the word, "game." During the development of VBS2 and Steel Beasts Professional (SBPro), the Australian Army began embedding the technologies into the classroom cultures. The schoolhouses became more adept, the warfighters more accepting, and a change had occurred. The current uses of VBS2 include: mission specific training, explosive hazard awareness and protection, convoy operations, aircrewman training, area of operations familiarization, and adhoc user initiatives. Current uses of SBPro include: Tactical Exercises

Without Troops (TEWTS), desktop gunnery, and combat officer collective training. Other tools used are tactical language during force preparation and Decisive Action for the Staff College. Current initiative and projects include: the Universal Training Terrain Project, support to fire control in VBS2 where they will useVBS2 as a step in the certification process, integration into other facilities and projects, wider dissemination throughout the ADF suing VBS2 Lite, support to capability development projects, replacement of ageing engines, integration into procedural trainers, integration into SAFs such as OneSAF and JSAF, and Classroom 21with simulation on the desktops. Australian industry initiatives include: Project Canary where the Queensland Mining Skills is using VBS2 for workshop management and awareness, and non-military applications that have direct military use. Key issues that Australia is currently dealing with are perceptions beyond the game, and the question of what level of fidelity is good enough; and that the games must be able to scale. In order to overcome a multitude of issues, Australia is developing a series of key documents including training management plans, simulation user guides, instructor handbooks, commander's guides, and an Army Simulation Strategy. Opportunities presented (but more an analysis of trends) are: need for strategic reform and cost cutting with the tightening of fiscal policies, efficiency and effectiveness reviews are occurring, they realize a need to train in a coalition environment, and senior leadership finally "gets it." In summary, game technologies are here to stay, we as a gaming and game technology community need to learn from each other, we need to maximize the opportunities to exchange information, and we need to provide structure and design to the application of the tools instead of just playing the game.

5.8 GaMeTT by Pete Schrider, MYMIC

Mr. Pete Schrider provided an overview of virtual worlds, a description of MYMIC's GaMeTT product and a partial demonstration of the product. During his overview, Mr. Schrider defined virtual worlds, provided concrete attributes of virtual worlds as defined by IARPA, discussed the graphical landscape, and discussed the key component – the avatar. He then described the GaMeTT product which is based on Forterra, Inc's On-line Interactive Virtual Environment (OLIVE) product where the goal is improved team performance of an operational task. The first use case is medical team training. Potential applications include rapid emergency response, counter narcotics/counter terror, National Guard response teams, and personnel evacuation to name a few. GaMeTT allows teams to train together online in a 3d environment under simulated realistic conditions including movement through the environment, interacting with other team members and patients, working with mission or organizational specific equipment, performing positional duties, and a method to retrain tasks. With GaMeTT, the user (or instructor) can easily configure the scenario by choosing from a library of scenarios, reconfiguring the environment, setting difficulty switches, injecting events into the scenario in real time, and configuring data collection to support the AAR. The value to the trainee is they can with a team from any location, learn and practice procedures, evaluate alternative CONOPS, and it allows mistakes in a forgiving environment. Current development includes: an Inventory Manager plug-in and GUI, Scenario Manger/Flow Control GUI and a scenario editor.

5.9 NATO MSG-078 Plugup: The Story Behind My Failure by Jenn McNamara, BreakAway Ltd.

Mrs. Jenn McNamara provided an overview of her effort to bring mosbe, a BreakAway product to the intended MSG-078 Plug-up. At the conclusion of her briefing she led a discussion with the group of issues that the group must face in order to achieve an actual plug-up in the future. BreakAway had intended to bring mosbe as their contribution to the plug-up. Mosbe offers exercise support for up to 32 players over a LAN with integrated AAR capability and white cell command capability. It contains over 600 military and civilian vehicles, 200 sensor systems, and 150 weapon systems and it is optimized to support up to 2500 units. Mosbe has a wide range of application including training and rehearsal, end user simulation control, an experimental

sand box, new concept visualization, and it can connect disparate simulations. Mrs. McNamara detailed the chronology of her effort with the RTO, ACT, and NATO staffs from MSG-074 until arriving at MSG-078. She then made recommendations on how we can actually succeed at achieving a plug-up. During the Planning Stage, she recommends that we hold a planning session and address federations (one or more), simulation world definition including location and size, the scenario, which assets, the FOM and RTI, exchange technical points of contact from each organization, and any limitations on data usage. During the Preparation Stage, an authority must provide the terrain data, FOM and key attributes, scenario parameters, and conduct coordination teleconferences. During Execution Stage, a dedicated secure room with time to setup and test the federation must be provided, then plan to demo the whole federation then allow each participant to explain their role while still in the federation. Other issues offered up during the discussion at the end included: determining the training case (why do a plug-up), who will provide RTI licenses and how, focus should be on COTS and exploring the technologies, terrain representation such as round earth or flat earth, behavior differences, and determining the reasons for conducting the plug-up such as technology refresh issues or adding to the current federation to provide options.

5.10 What's Changing: My Perceptions and History of Simulations by Matt Spruill, SAIC

Mr. Matt Spruill provided the scene setting briefing for day two of the conference. His stated purpose was to provide the audience his perceptions on what is changing in the modeling and simulation world today. In order to do so, he provided his personal account of his experience with simulations, and then presented an analysis of where the market is heading and why. Mr. Spruill discussed his experiences throughout his military career starting with ARTBASS. He did not have a good experience, not because of the simulation, but because of the use of the simulation and the design of the exercise. Later in his career, he was introduced to the Joint Theater level Simulation (JTLS) which met most of his unit's training requirement, but they were forced to federate other simulations in order to meet their needs and the federating of the simulations was at a high price. Mr. Spruill then provided a history on the development of the all service entity based federation, the Joint Live Virtual Constructive (JLVC) Federation. The JLVC is a great federation but it too comes with a price. The history lesson was the scene setter for the analysis. Mr. Spruill has observed that single simulations have not met the need, thereby resulting in the federating of simulations as we have seen in the last 8 years. But, he is currently observing a dramatic decrease in the demand for large simulations and a move to more efficient, leaner, light weight solutions. He surmised that this trend is due to economics, a desire by the community to reduce duplication, the collaboration that is occurring between users and developers of simulations, and that the culture of the users is changing. He also suggested that emerging ideas such as lightweight desktop simulations, smaller bite sized training scenarios, the use of advanced distributed learning, gaming, and virtual worlds are beginning to flourish. Given that the new technologies are present, Mr. Spruill concluded that our community must accomplish two tasks in order to further advance the use of these emerging concepts: determine the training case for the technologies instead of just displaying them to users, and change the mindset of the policy makers.

5.11 UK MOD Serious Games Research – Looking to the Future by Stu Armstrong, QinetiQ

Mr. Stu Armstrong provided a presentation on the background of the UK MOD's work in serious gaming, their current projects, and a snapshot into the future. The UK MOD identified serious games as a key area for exploration. The COTSEU was established to act as the focal point of the research with the mission of providing advice to the UK MOD, liaise between developers and users, and to provide capability demonstrations. While the UK has explored and is utilizing a variety of serious games, three topic areas are currently in work: the IED Situational Awareness Tool, aviation tactics training, and helicopter brown out. All three support training for current operations. Mr. Armstrong presented his view of the technology

roadmaps for network technology, terrain generation, input methods, and simulation. Over the next ten years, he predicts that we will have super fast network access anywhere, anytime; fully automated terrain generation of whole-world from multiple sources; input sources will be from emotion recognition, eye movements, thoughts, and haptic devices; and simulations will have common model and terrain formats with single visualization. He concluded with an example future command and control vignette using a recent fourteen year olds campaign plan and execution in a MMOG called "Eve On Line."

5.12 Commercial Gaming in the Canadian Forces by MAJ Jeremy MacDonald

MAJ MacDonald provided an overview of his organization, their current projects and future work. His primary mission is to develop capabilities and recon for what is available in the community. One key aspect of his organization is that he is using college interns to support his work. Recent completed projects include Direct Action, Federiction Core, and 3D Model Exchange. Current projects include IRET, WIC/Federiction expansion, Turret Sim, and Parachute Sim. The Immersive Reflexive Engagement Trainer is a capability that incorporates video games, but still allows soldiers to "kick in the door." This capability is an immersive trainer that posts video imagery on walls. It also uses motion capture, feedback vests, simulated flashbang grenades, speech recognition and they are exploring the use of firing rounds through walls. The WIC Federiction project is intended to support call for fire training for the Combat Team Commander's Course where they course currently conducts the training in an urban area through TEWTs. The purpose of the Turret Sim is to develop a LAV-25 training turret for gunnery training without having to rely on having a vehicle present as used in the existing system. The system is a mock up of the turret using VBS2 as the engine, and replicating the controls. His future work includes Augmented Reality to blend real world and virtual worlds together, the Microsoft Surface Table to train commanders on tactics and organic motion for full motion capture.

5.13 Dangerous Waters by Mike Gracewood, CFMWC

Mr. Mike Gracewood presented a program brief on Dangerous Waters, a serious games use at the Canadian Forces Maritime Warfare Centre. The project goals were to improve the capability to conduct littoral operations, demonstrate effective application of air platform resources, and to explore the impact of M&S technology to tactics and doctrine issues. Tools used for the project included JSAF-HFF, Dangerous Waters, and the Data Management Tool (DMT). Current activity includes an assessment for verification and validation purposes by the CFMWC and evaluation for training within the 12/14 Air Wing. Future work will include completing the evaluations, providing configuration management for the users, integrating compatible tools sets, and model improvements. Valuable lessons learned and observations have been made throughout the project. One of the key lessons learned is that acceptance of a game in a military environment has been very difficult. While V&V is the responsibility of the developer, the onus of accreditation is on the user which means that the user must accept the game, and then accept changes/modifications to the game. For configuration management, CFMWC provides sites licenses (10 per site), accepts changes requests and manages the changes centrally. Finally, a key comment was that for proprietary software, the government agency must determine in the lifecycle how much code you have access to during a project.

5.14 NATO VBS2 by Lt Col Chris Hall, ACT

Lt Col Chris Hall presented NATO's current VBS2 project to provide an advanced distributed tactical training tool for C-IED Force Protection training to supplement ADL courses. NATO VBS2 is a version of VBS2 and this project fits into the Simulation Advanced Distributed Learning project under Snow Leopard. This project is in direct response to a C-IED training identified deficiency amongst the nations. NATO will provide clients

with pre-loaded C-IED training content including the Insurgent Mindset Training developed for the USMC, a train the trainer course, and C-IED multi-player scenarios. The intent for use at the JWC and JFTC is for NATO VBS2 to provide visualization for other constructive simulations, support the creation of enhanced presentations, reuse scenarios built in the school houses, and provide a free platform for experimentation. NATO will provide the clients, the VBS2 VTK at a reduced cost, access to the NATO servers on a time share basis, and a moderated portal. Services will be established by December 2009. Identified issues that could cause problems include: maturity of the concept, a paradigm change required, availability of content, security, accreditation, resources, national POCs, and identifying a configuration management POC.

5.16 Breakaway Demonstration by Jenn McNamara, Breakaway, Ltd.

Mrs. Jenn McNamara provided a company overview of Breakaway, Ltd and product demonstrations/overview of their products. In the company overview, Mrs. McNamara surmised that game base technology is much more than just the shooters, defense customers are searching for different things. Products demonstrated included the Expeditionary Airbase Sim (EAS) used to teach people how to set up an expeditionary airfield, mosbe used as a mission planning simulation with integrated after action review, scene builders and is HLA compliant, Incident Command used to train local and individual first responders on the National Incident Management Protocol (NIMS), Vox Populi which trains the strategic planning process and effects of actions, PULSE and Virtual Dental Implant Trainer both focused on health care.

5.17 JCATS with a Virtual Desktop by Amy Grom, JFCOM

Mrs. Army Grom provided two demonstrations of current JFCOM capabilities. The first was a Joint Theater Level Simulation (JTLS) / Joint Conflict and Tactical Simulation (JCATS) / VBS2 federation demo and brief. Mrs. Grom also tied it in with current NATO Training Federation capabilities. The vignette utilized to demo the project was a time sensitive target (TST) vignette. The second demo was a DI Guy and JCATS federation using Distributed Interactive Simulation (DIS). The federation uses the VMASC insurgency model work as well.

5.18 VBS2 Modules by Peter Morrison, Bohemia Interactive Simulation

Mr. Peter Morrison presented his vision and company's plans to provide a more robust, easier method to access the VBS2 engine in the future. He began by describing the VBS2 VTK components. He discussed the Application Scripting Interface (ASI) and that it allows developers access to over 1300 commands in the VBS2 source code and allows for the creation of VBS2 plug-ins. However, in order to capitalize on the API, a developer needs to know the 1300 script commands. His solution to this problem is the creation of the VBS2Fusion API that provides functions, can be up to 200 times as fast, and requires no knowledge of VBS2 scripting. He is doing this because it fits into his company's long term goal of converting core engine capability to lightweight, customizable modules that can be portable across game engines and platforms. He is setting up for establishment of a standard API that the industry can work towards.

5.19 Multi-level, Multi-Resolution Gaming by Julian Mallett, MAK

Mr. Julian Mallett presented the case for multi-level, multi-resolution gaming. He revisited history and reminded us that there was a time when people stated that games could not be serious. He also reminded us that "team play wins." Mr. Mallett stated that while games are an essential part of the solution, they don't model the entire process thus integration of multi-level, mutli-resolution games and simulations are necessary to train the essentials of command, control and communications. MAK's objective is to provide an

environment to explore current and future combat operations, sharpen decision making skills, and broaden experiential skills. MAK's experience in the gaming world through their products include: Spearhead, Game Link, BC-2010, DARWARS training package, and Quickstrike. He concluded with detailed descriptions of the concepts of multi-resolution modeling, ownership transfer, and systems of systems architecture; and then explained their relevance towards end-to-end decision making skills training.

5.20 Damage Control Demonstration by Curtis Murphy, AlionScience

Mr. Curtis Murphy provided a demonstration of the Damage Control game developed by AlionScience for the Office of Naval Research (ONR). The goal of the project was to build a game that improved new recruit training. The intent of the game is to allow students, many of which have never been on a ship, to be in the environment and learn as they go, making mistakes prior to boarding a ship. Key to the process was real-time assessment of progress and feedback to the student. He concluded with a demo of the game.

5.21 Energy Gaming and Governance Impact of Tangibles and Intangibles for DMP by Dr. Adrian Gheorhe, Old Dominion University

Dr. Gheorghe presented a demonstration of an online game focused on energy independence decision making. His premise is that countries want to be energy dependent and in order to do so must be able to train to make the right energy mix decisions. His game is web-based and has four components: Primary Mix Issues, Security Issues, Resilience Issues, and Health & Environment Issues. Primary Mix allows the player to look at options for different energy solutions. Security allows the player to assess the vulnerability of energy assets. Resilience displays results of a system's resiliency to recover from disastrous events under differing conditions. Health & Environment display environmental effects of pollution.

6.0 PANEL DISCUSSION

A panel discussion without presentations was formed during the conference to allow open discussion of topics and ideas. While the discussion was formed around several topics, as expected, there was a great deal of divergence from the main issues and topical discussion amongst the group. Generally, it started with a discussion of business models that lead to a discussion of exploiting technology which lead to a discussion of large vs small businesses. Below represents the main topics with their associated comments from the group. Some of the comments are statements, some questions, and some pure opinions. Specific names are generally not associated with the comments in order to facilitate and encourage discussion at future conferences except when the question or comment specifically addresses an organization or company.

6.1 Topic: Business Models to leverage Serious Games

General comments:

- Those that want to build their own games go GOTS.
- In the UK, there are two general means for COTS solutions. However, the procurement personnel must be convinced that the risk is low:
    - Under the wire, meaning outside the normal acquisition process where speed and agility are required.
    - When there are no formal, written requirements.
- Large programs, when training is a small part of the overall program, cannot risk going with a small company because of the risk to the overall program.

- One of the key issues with screening a small business out of the competition for an opportunity is that a small business may not be around next year and this increases the risk.
- Most innovation and research is done on a companies own nickel.

6.2 Topic: Exploiting Technology

- Question: Are you (governments) really here at the conference to try and exploit commercial games and what are you going to do about it?
- Follow up questions: What are the mechanisms if you are going to exploit commercial technology? The US has a BAA process, but how does NATO do it? What is the business model?
    - The UK MOD has the Defense Industrial Strategy that outlines the process. Basically it reduces primes to a manageable level. Small companies should partner / sell their products with primes. Bottomline, we want to deal with small companies as well.
    - The UK is attempting to develop relationships with small and medium companies. Primes don't innovate enough and in order for the UK MOD to bring in innovation, they are starting the Synthetic Technologies Tower project.
    - The UK is not looking at specific systems, they are seeking key technologies. Therefore, unsolicited proposals are acceptable.
    - In NATO, the reason for this workshop is to share info on these technologies in order to share and display the technologies to the NATO nations but integration of the technologies is largely through the primes.
    - One thought is to develop a collaborative environment for development. Authors comment: Such as a Cooperative Research and Development Agreement (CRADA).
    - Exploiting is about finding new technologies and ideas.
    - Question: Do we really expect to exploit commercial technologies?
        - Yes
        - One way to exploit is to be disruptive.
    - Question: What is exploiting and how is it going to occur?
        - Exploiting of technologies will and must occur in the nations, NATO just provides the mechanism to see it through conferences such as MSG-078.
        - An example of exploiting a technology is the "Training of Individual Augmentees for Deployed Staffs Using Virtual Worlds" experiment that ACT is involved in with JFCOM and two companies, one large and one small.
        - Exploiting in NATO is difficult. However, methods to do so include:
            - Being disruptive and finding a champion in the government.
            - Subverting the acquisition process and getting directly to the users – that's disruptive and they become your champions.
        - One thing that must be considered is how much and how to accomplish deploying a system on the unclassified and classified networks.

6.3 Topic: Myths of Serious Games Companies and Primes vs Vendors

- Perception: The perception that serious games companies are building games and repurposing them for defense use is a myth.
    - If a company is not generating revenue from somewhere else, such as the entertainment games market, then they are just defense contractors and not a games vendor.

- Question: is there pressure for the game companies to become a defense contractor vice a vendor of games?
  - Yes, from both sides.
- Serious games vendors that focus on defense stay in the games business for innovation and to develop new technologies.
- We (the government) expect that this is happening and want to leverage the new technologies because the governments like COTS to stay pace with new technologies.
- Games vendors are leveraging technologies but not repurposing specific games.
- Question: Is there any advantage to entertainment games companies to have endorsements for their serious games by governments?
  - No, not in the entertainment industry. Most entertainment games companies are not interested in the defense market, thee simply isn't the money in the market like the entertainment market.
- Some small business started with the model of targeting their products for the primes but found out that the primes don't want them to grow, they want them to stay small.
- The strength of a game company is the speed of advances in technology or its products. The key is a high level API specification where the large primes can use the small company products through the APIs.
- We, the primes, are the way we are because you (the government) made it that way. You want low risk, large companies that can offer affordable solutions.
- Don't forget about academia, they have a stake in this problem too.

6.4 Topic: VV&A and Feedback

- Verification, Validation and Accreditation
  - Question: Is it VV&A or is it Quality Assurance?
    - One comment from a small business games vendor – they would rather go thru the Army VV&A process than the Microsoft QA process because of time and funding requirements.
- COTS User Groups:
  - Some would like military driven user groups in order to get feedback in general and in more real-time like the entertainment industry has established.
  - It was stated that the vendors need feedback from the users on their products. But, the problem is that it is not an easy process for legal reasons.

7.0 CONCLUSION AND RECOMMENDATIONS

7.1 Central Themes throughout the workshop

During the course of the workshop, several themes or "hard questions" were identified including:

- Business Models – What are the business models that governments will use to procure commercial games and technologies? What is the appropriate business model for industry?
- Workshop intent and purpose – What will the NATO nations do to exploit new technologies and commercial games that they learn about at the workshop?
- Large vs small business – What are the roles for the larger prime companies and the roles of the smaller games vendors? How do they best work together?
- Changing environment – The focus on the use or potential use of new technologies is changing, but how are the governments and industry going to adapt?

- Workshop plug-up – There is a desire for the government to see working demonstrations and a desire for industry to meet a plug-up challenge.

7.2 Conclusion

With the aim of the workshop to provide a venue to explore through demonstrations and presentations the "hard questions" related to exploiting commercial games and technology, to provide updates on the nations' current application of commercial technologies, and to provide capability briefings and demonstrations of commercial technologies with immediate potential for use in a distributed manner through VTC, virtual worlds or other means then the workshop was a success. The only objective not met was to conduct a plug-up using a common multi-national scenario. Most of the hard questions, while asked throughout the workshop, were highlighted during the open panel discussion at the end. The open panel discussion was one of the most beneficial portions of the workshop as it provided the mechanism for the participants to begin to shape the "hard questions" into manageable topics for further discussion at future workshops.

It is clear that NATO nations are currently using commercial games and technologies, and based on the remarks from the group, there is a need and a desire to continue to pursue commercial games and technology solutions even given current procurement guidelines. NATO and ACT have the organizational infrastructure to facilitate these types of workshops and should continue them.

7.3 Recommendations

- For future Exploiting Commercial Gaming and Technology for Military Use workshops, analyze the outcomes / unanswered issues from this workshop to shape the agenda and presentations of the next workshop.
- Continue to sponsor and conduct the Exploiting Commercial Gaming and Technology for Military Use workshops as it provides an enterprise view of new games and technology as well as individual nation's applications of them. Using workshops in this manner facilitate NATO and ACT's role in standards, interoperability, and best practices as well as highlighting new technologies.
- Use the NATO Research and Technology Organization to cast a wider net for participation amongst the countries not represented at the workshop.
- Develop a deliberate plan to conduct a plug-up of the latest commercial games and technologies within the NATO M&S roadmap to offer opportunities to innovative companies while providing valuable information to national representatives.
- Develop a mechanism to involve academia into the agenda for future workshops. Numerous academic institutions are developing new and innovative technologies and techniques and should be included in a public / private workshop such as MSG-078.
- Continue to be an example in the application of new technologies by offering a distributed, collaborative means to participate in the conference from remote locations.

MSG-093 - Exploiting Commercial Games and Technology for Military Use
9th Workshop
(RTO-MP-MSG-093)

Executive Summary

Objective of the Workshop

The aim of the workshop is to share national experiences, explore commercial and games technologies, understand best practices, and to identify barriers to further exploitation and ways these barriers might be overcome. In particular, the workshop will investigate issues surrounding virtual worlds and similar technologies as they apply to using these technologies in military applications. Three dozen experts will join together at the new M&S Centre of Excellence in Rome to discuss, debate and determine the future steps required to ensure that the interoperability of virtual world use in NATO is a success. The workshop will include a recap of the key points from MSG-074 and MSG-078 held in 2009, and is followed by presentations and discussions. The investigation will include a definition of the challenge, development of an understanding of what needs to be overcome and possible solutions to the challenge. This methodology will enable the development of a consensus strategy by participants as to how they may continue to further exploit these technologies.

Conduct of the Workshop

MSG-093 was conducted 2-4 November 2010 at the NATO Modeling and Simulation Center of Excellence in Rome, Italy. The workshop was attended by 45 invited ACT, NATO national representatives, and industry personnel participating in 15 presentations and demonstrations. The workshop was distributed via Harmonie Web for remote participants.

Conclusion

With the aim of the workshop to share national experiences, explore commercial and games technologies, understand best practices, and to identify barriers to further exploitation and ways these barriers might be overcome; and then to investigate issues surrounding virtual worlds and similar technologies as they apply to using these technologies in military applications, the workshop was a success. There was much discussion involving the entire group on these issues. Particularly notable is the position statement that was crafted by Dr. Roman based on his observations of the debates and agreed upon by all at the workshop.

NATO Modelling & Simulation Group (NMSG) Workshop
Exploiting Commercial Games and Technology for Military Use

Summary of Proceedings

1. PURPOSE:

The purpose of this summary of proceedings is to document the NATO Modelling & Simulation Group (NMSG) MSG-093 Workshop on Exploiting Commercial Games and Technology for Military Use In NATO.

2. OBJECTIVE OF THE WORKSHOP:

The aim of the workshop is to share national experiences, explore commercial and games technologies, understand best practices, and to identify barriers to further exploitation and ways these barriers might be overcome. In particular, the workshop will investigate issues surrounding virtual worlds and similar technologies as they apply to using these technologies in military applications. Three dozen experts will join together at the new M&S Centre of Excellence in Rome to discuss, debate and determine the future steps required to ensure that the interoperability of virtual world use in NATO is a success. The workshop will include a recap of the key points from MSG-074 and MSG-078 held in 2009, and is followed by presentations and discussions. The investigation will include a definition of the challenge, development of an understanding of what needs to be overcome and possible solutions to the challenge. This methodology will enable the development of a consensus strategy by participants as to how they may continue to further exploit these technologies.

3. WORKSHOP AGENDA

Tuesday 2 November 2010

1330 – Administration and Welcome

1345 – Keynote – "The Experiential Based Learning Renaissance – Putting Serious Games and Virtual Worlds in their Places"

1430 – "What Has NATO Been Doing?"

1530 – "Intersections and Differences / Virtual Worlds and Serious Games"

1615 – Virtual Reality Simulation for Disaster Response Training

Wednesday 3 November 2010

0845 – Daily Review

0900 – "Virtual Worlds: the Real World Analogies"

1030 – "Exploiting VBS2, Open Source, and Consumer Electronics for Research and Training"

1115 – "NATO Implementation of Training Technologies"

1200 – "Strategic Simulation Software"

1330 – "VBS2 Technology on Thin and Mobile Devices"

1415 – "Integrating Cultural Simulations into Virtual Worlds"

1500 – "Virtual Worlds Architectural Framework"

1600 – "Virtual Worlds: Next Steps for Interoperability"

Thursday 4 November 2010

0845 – Daily Review

0900 – "Ground Truth – An Open Architecture to Support a Common Virtual World"

1030 – NATO M&S COA POW

1100 – M&S COE Facility Presentation

1130 – Technical Evaluation Report

1200 – Workshop Wrap Up

4. PARTICIPANTS

COL Francesco Masterosa	Ramin Danisiro	Chiaretti Lamberto
Wayne Buck	Craig Swift	Paolo Zaghi
Matt Spruill	Edward Jones	Paolo Prioetti
Peter Morrison	Hans-Werner Lindert	Andea Comite
Paul Roman	Jiri Pail	Jerzy Gryzb
Lewis Johnson	Agatino Mursia	Daniusz Pierzchala
Paul Thurkettle	Petr Pavlu	Marius Van Wungaarden
Allan Gillis	Luca Gargiulo	LCdr Dimitrios Fillagos (Remote)
Stu Armstrong	Juan Ruiz	Angelo Preveti (Remote)
Marco Van Wijngaarden	Julie Tremblay	Colin Bigg (Remote)
Tracey Cheasley	Meelis Soukland	David Smith (Remote)
Ron Edwards	Lauro Reino	Federico Guano
Carlos Alberto Belinchon Pinedo	John Milam	Oystein Ramseng
Hilde Hafnor	Tim Mahoney	
Patrick Samama	Mabel Mussini	

5. EXECUTIVE SUMMARY OF PRESENTATIONS

5.1 The Experiential Based Learning Renaisance – Putting Serious Games and Virtual Worlds in Their Places by Dr. Paul Roman

Dr. Paul Roman provided the keynote address to the workshop and his perspectives on Serious Games, Virtual Worlds, the Future Immersive Training Environment (FITE), and evidence of learning effectiveness. Dr. Roman began with a short history lesson and the simulation renaissance caused by the emerging from the decade of darkeness where training and learning moved from live classroom to serious games to virtual worlds to technologies such as the Future Immersive Training Environment (FITE). He then described some experiential learning guidelines and how serious games met tactical training requirements. His Training Needs Framework presentation led to his analysis and proof of the efficiency and effectiveness of serious games for training using the Armour Troop WO Course as an example. In this portion of his presentation, Dr. Roman provided evidence of a nearly $50,000 savings through the use of VBS2 in the training curriculum as well as an increased pass rate from 72% to 100%. He provided additional evidence from studies and experiments in Australia, the United States, and the United Kingdom. This all led to a definition of Roman's Rule: Given a robust set of serious games rehearsals that, 1) Create an adequate degree of immersion or presence in a meaningful context, 2) Employ good experiential learning guidelines, and 3) Employ good After Action Review; Trainers can expect to go from 75% to 95% effective in about half of the time that would have been required with live training on its own.

Dr. Paul Roman continued his presentation with a description of what is a virtual world and attributes of virtual worlds, and how they can be viewed or utilized within the US Department of Defense's Development of Interactive Multimedia standards. Dr. Roman then transitioned to the FITE program. Dr. Roman described the technology of the OD1 FITE Joint Capability Technology Demonstration (JCTD) as well as the four investigative areas. He then provided analysis and the outcomes of the first two objectives: Realism and Effectiveness. In conclusion, he asked two questions that set the tone for many of the discussions throughout the workshop: 1) Can we afford all these technologies, and 2) Is it a serious game or a virtual world, and does it matter?

5.2 What has NATO Been Doing? By Wayne Buck, NATO ACT

Wayne Buck provided a presentation of NATO ACT's foray into virtual worlds through a description of their activities in virtual world development and experiments as well as background on NATO ACT's M&S activities and responsibilities. Mr. Buck began with description of NATO ACT's investigation into virtual worlds. He described the experiments that NATO ACT has conducted in collaboration with JFCOM and industry partners to determine the efficacy of training staff officers in a virtual world, as well as the recent development of a virtual world of the new NATO ACT building and a training game based on a virtual world for the NATO Maritime Interdiction Operations Training Center. Mr. Buck then provided the history behind NATO ACT's involvement in the M&S community by describing the ACT organization and its relationships within the NMSG and other NATO organizations leading up to the "Ambition Continuum." The "Ambition Continuum" being the activity areas of Infrastructure and Process Development, CAX Forum and CAX Courses, Education and Training, Applications and Networks, and Interoperability and Standards cross matrixed with the four deliverables or products of the Afghan Mission Network (AMN), Snow Leopard, the Distributed Networked Battle Labs, and the Common Technical Framework. Mr. Buck concluded with the challenges NATO ACT faces: level of ambition versus possible level of effort, integration into the existing NATO M&S community, and resources in general.

5.3 Intersections and Differences / Virtual Worlds and Serious Games by Doug Whatley, Breakaway Ltd.

Mr. Doug Whately began his presentation with a discussion of definitions of different game types: virtual worlds, multi-player, massively multi-player, role player, and first person shooter; and then surmised that most people or customers use them interchangeably but, in fact, their mechanics make them different experiences for the user. Mr Whately used the analogy of two popular board games that had similar themes but different mechanics which made them different experiences for the players – Risk and Diplomacy. Both have similar themes of world conquest, territorial control and army tokens. But both have differing mechanics. Risk employs sequential turns while Diplomacy employs simultaneous turns. Risk employs probabilistic combat while Diplomacy employs deterministic combat. This example provided the background behind the remainder of his presentation - the experience a user has in different game types is due to the mechanics of the user view and controls. He pointed out the different movement techniques such as point and click for direct movement versus the W-A-S-D method of movement in the different game types as well as the view the user has during game play and how different employment techniques of textures, lighting, eye focus, and pathing are used to create the experience for the user. During the presentation much discussion occurred around the ideas of the buy versus make decision, what is the right answer on reuse of code, applying the technology to the training, standardization, and the notion of what is good enough. Mr. Whately concluded with, the answer to the user experience and the right application of the technology is in the design.

5.4 Virtual Reality Simulation for Disaster Response Training by Marco Van Wijngaarden, ETC Simulations

Mr. Marco Van Wijngaarden presented an overview of Environmental Tectonics Corporation, and overview of the Advanced Disaster Management Simulator (ADMS) and a description of a recent practical application of ADMS. ADMS is a simulator replicating a real situation to train coordination center staff, field commanders and vehicle operators during emergency operations. ADMS employs accurate incident and locations, real-time dynamic simulations, embedded AI + physics based threats, and an immersion theater. Mr. Van Wijngaarden described a recent application of ADMS called the New York Project. In doing so, he described the requirements of the system to meet the training objectives. He pointed out the levels of terrain fidelity required, the fidelity and breadth of the vehicles required to provide realism, the types of injuries and graphical display of the injuries on the characters, and how the incident field commanders interfaced with the simulator. Mr. Van Wijngaarden displayed numerous example screenshots throughout the presentation that highlighted the ADMS capability. The key discussion point with the group centered around the level of fidelity required for any system and whether or not geo-specific or geo-typical terrain is really required.

5.5 Virtual Worlds: the Real World Analogies by Stu Armstrong, QinetiQ

Mr. Stu Armstrong presented real world examples of very popular games and how they can and have been used for purposes other than entertainment. Mr. Armstrong began with the question of what is a virtual world and referenced Ola's Law About Laws and Dr. Cat's Theorem to guide his points. He then used three popular games to highlight applications of games for learning and training: World of Warcraft, Eve Online, and I Love Bees. In the World of Warcraft example, Mr. Armstrong displayed a video capture of a team preparing for battle. This highlighted the mission briefing and leadership actions necessary for successful mission accomplishment. He also pointed out that because an online game used daily by millions of players can have language challenges, a US university taught language skills by having their students log into German language World of Warcraft servers to facilitate the teaching of the German language. Additionally, he pointed out an article about how infectious disease research can be conducted in an MMO. In the Eve Online example, Mr. Armstong described the game and tis environment. He spoke about the Eve Economy and how in game money has been stolen; how Eve wars have been planned, rehearsed, and conducted; and

how intelligence has facilitated the conduct of the wars. Most importantly he highlighted how a rehearsal was conducted in Second Life for a war in Eve Online to protect the security of the plan while still offering a rehearsal site for the operation. He concluded that we can and should take advantage of these games to train for operations. In the final example, Mr. Armstrong showed how the game, I Love Bees, was used as a marketing campaign for Halo 2.

5.6 Exploiting VBS2, Open Source, and Consumer Electronics for Research and Training by Allan Gillis, Defence Research and Development Canada

Mr. Allan Gillis presented the Defence Research and Developent Canada's (DRDC) work in the development of vHarbor and the vRHIB, the recent application of the system in support of a security event, and lesson learned throughout. Mr. Gillis began by discussing vHarbor. He presented the purpose of the work – research of the command and control systems of a ship in port for local protection. He then described the layout of the base operations center, the system design and components, the details of the equipment used in the system, and a layout of the facility. He displayed pictures of the vRHIB and the transition of the vHarbour system to the vRHIB system that was used to train personnel for security operations during the Canadian Navy's 100 year celebration. Mr. Gillis highlighted the significance of the system as the port security detail, which was newly formed, used the vRHIB to train for the event. He concluded with lesson learned from the program: trainers need more time to integrate new tools into their lesson plans, vRHIB is still more complicated that it needs to be for the training community, some of the game hardware was too fragile, USB headsets limit what you can do with sound, and if all players are in one room the radios probably aren't needed.

5.7 NATO Implementation of Training Technologies by Paul Thurkettle, NATO ACT

Mr. Paul Thurkettle presented an overview of the Education & Training Technologies Section's mission and what Advanced Distributed Learning means to NATO, the NATO schools, challenges for learning, overall challenges, and the future outlook of their projects. Mr. Thurkettle presented the NATO ADL vision and what it means in practical terms. In a nutshell, it means "eLearning." Mr. Thrukettle then provided an overview of the NATO Education and Training facilities and the different NATO networks supporting ADL. He presented his challenges for learning as: stop "death by powerpoint" in courses, promote "peer learning," syndicate and teamwork, apply knowledge, use simulation to enhance individual training, use distributed learning and training to reinforce learning, time limitations, resources, and meet new "just in time, just enough" policies. His overall challenges are: the first look at a new technology or system is very important to gain support; the name is very important – is it a virtual world or a serous game; a deliverable must be delivered; his customers are expecting state of the art in new systems; and new systems must appeal to and apply to all ranks from four star to no star. Mr. Thurkettle then presented the future of NATO education and training as, in general, mobile devices, web and computer based training, and serious games and virtual worlds. Specifically, he presented three products: NEXUS virtual worlds use in staff training and the NMIOTC ship boarding training, VBS2 for applications such as Counter-IED training, and Tactical Language & Culture Training Systems. Mr. Thurkettle presented NATO ACT's investigation into mobile devices.

5.8 Strategic Simulation Software by Tracy Cheasley, NATO ACT

Mrs. Tracey Cheasley provided an overview of NATO ACT's effort in the use of a strategic level simulation, the lessons learned, and a demonstration of the simulation. The challenge she was faced with was how to provide a training tool at the strategic level (not necessarily a 3D tool) that would replace an old paper based system. The lessons learned are categorized into two topics: the tool and the process. While they had a firm starting point and a clear aim, it was sometimes difficult to have a clear understanding of the requirements, and it was difficult to have an understanding of how to ask the developers the right questions during the development of the simulation. For the process lessons learned, they had to have a realistic compromise

between the desires and the available resources as well as developing the precise requirement. In the end, they chose Command in Chief as the simulation to meet their need. Mrs. Cheasley concluded with a demonstration of the simulation software.

5.9 Fusing VBS2 and Thinking Worlds by Peter Morrison, Bohemia Interactive Simulations

Mr. Peter Morrison presented an overview of VBS2 along with new features and future enhancements, an introduction to Bohemia Interactive Studio (BIS) and Bohemia Interactive Simulations (BISim), a new system called VBS Worlds, and his perspective on the term "virtual worlds." In his description of VBS2, Mr. Morrison presented the history of VBS2 along with the increases in fidelity of the system through the years. He also discussed new enhancements in progress such as paging terrain and an API for SE Core integration. Mr. Morrison also discussed several limitations; the fact that VBS2 is a single platform thick client application, and it is tailored for tactical training and mission rehearsal not addressing many other training needs. His mention of VBS2's limitation lead him to his next topic: introducing a new system, VBS Worlds. VBS Worlds is s fusing of VBS2 and Thinking Worlds from Caspian Learning that will allow for rapid scenario generation as well as thin client or mobile delivery. Mr. Morrison used the example of VBS2 Insurgency Mindset Training Network Enabled Training (IMT NET) for the USMC that allows for persistence and multiplayer interaction thereby making it a virtual world by definition. He mentioned this specifically because he does not want to be excluded from competition because a government does not consider VBS2 a "virtual world." He believes that, "If it is a virtual representation of a world, then it is a virtual world."

5.10 Integrating Culture Simulations into Virtual Worlds by Dr. Lewis Johnson, Alelo

Dr. Lewis Johnson presented the challenges of culture and language skills; the requirements of an operational language and culture suite; and an in-depth description of the architecture, design, and application of Virtual Role Player (VRP). As described by Dr. Johnson, intercultural skills are increasingly recognized as important for NATO operations, but language and culture proficiency can take a long time to develop, and once developed they can be difficult to maintain. Therefore, an operational language and culture training suite must be a coordinated set of distributed learning tools, that can be used individually or in combination, that addresses the readiness and sustainment problem, and the underlying technology is compatible with virtual worlds. Alelo's answer to the above problem and requirement is the Virtual Role Player (VRP). VRPs are artificially intelligent non player characters that perform culturally appropriate roles, that can engage in spoken dialog with trainees, can gain rapport with the trainees, can assess a trainees cultural skills, are instructor configurable, can integrate with multiple game engines, and have versions for Dari, Pashto, Arabic, and French. VRPs can be used to interact with users in three different ways; in language mode, in culture mode, and in a puppet or controller manipulated mode. Additionally, VRPs can be integrated into language and culture training systems, kinetic training systems such as VBS2, or mixed / augmented reality training systems.

5.11 Virtual Worlds Architectural Framework by David Smith, Lockheed Martin

David Smith presented the preliminary findings as a result of an effort sponsored by the US Office of the Secretary of Defense to determine a DoD wide virtual world framework. Mr. Smith presented a description of the Virtual World Framework that is scalable, future-proof, interoperable, and secure. The essential features of the next generation virtual world platform must: work across operating systems and devices, be easily deployed across an entire organization on both sides of the firewall, work with existing IT capabilities and security requirements, avoid being a captive solution, utilize and define standards, scale dynamically with new requirements, and lower the cost of content development while raising the level of quality and affordability. Mr. Smith then transitioned to the delivery mechanism of the virtual world framework, a browser based solution. He described the future of virtual worlds in terms of WebGL and HTML5, and

provided answers to why a browser-based solution in terms of the essential features mentioned previously. He also expounded on where the browser is headed and what the major browser vendors are currently doing. He concluded with speaking to his current activities in the conduct of the study.

5.12 Virtual Worlds:Next Steps for Interoperability by Matt Spruill, Engineering & Computer Solutions

Matt Spruill presented an overview of Engineering & Computer Simulations (ECS); an overview of the virtual world effort for NATO ACT; a demonstration of Boarders Ahoy!, a game based on the NEXUS Virtual World platform; and an operator's view of 5 levels of interoperability that the community should strive to achieve in the future. Mr. Spruill presented ECS's core capabilities and then provided greater detail of their NEXUS Virtual World platform and examples of serious games for training and education developed by ECS. He then provided an overview of the NEXUS Virtual World developed for NATO ACT both for the new headquarters building and the ASIA compound that was previously utilized during an experiment as a game in an effort to determine the efficacy of using virtual worlds for staff training. Mr. Spruill then provided a live demo of a game based on the NEXUS Virtual World platform called Boarders' Ahoy! in support of the NATO Maritime Interdiction Operation Training Center. Mr. Spruill presented his ideas on the levels of interoperability that the virtual world community should begin to work towards. The first level, called Basic, would share simple information about a person or avatar such as name, age and gender from platform to platform. The second level, called Profile, would be the sharing of a complete profile analogous to Linked In sharing a profile with Facebook. The third level, called the Window, would be where a person represented by an avatar could see from his world into another virtual world through a window. The fourth level, called the Door, would be where an avatar could not only see through a glass door form his world into another, but then he could open the sliding glass door and step through into the other virtual world. Finally, the fifth level, called Behind the Door, would allow an avatar from one world to enter another, and then physically interact with objects and other avatars in another world. Mr. Spruill concluded with stating that this is necessary because our customers are demanding these capabilities and driving us to them.

5.13 COTSEU Aviation Tactical Training by Stu Armstrong, QinetiQ

Mr. Stu Armstrong delivered a second presentation providing an overview, the requirements analysis, and initial findings of an investigation into a COTS solution to support theater specific tactics training for the Apache, Sea King, Puma, Chinook, Lynx and Merlin helicopters. Recently, the UK Joint Helicopter Command has requested that COTSEU conduct the investigation. The primary problems identified were that current tactics trainers focused primarily on the AH community and the current solutions are inflexible, expensive and slow to develop compared to the COTS based solutions. Requirements included: key instruments represented, rapidly reconfigurable, mobile, and use COTS solutions where possible. Based on the requirements and interviews, a VBS2 demonstration was conceived providing a single simulation to represent the current operational environment within an immersive environment. They concluded from this that VBS2 and COTS technology is capable of producing a wide field of view, VBS2 engine allows for highly detailed geo-specific terrain to enhance training value and levels of immersion, and the instrumentation method employed allows for the rapid construction of any instrument. The final conclusions of the investigation were that availability of certain hardware such as flight control grips are an issue, GPUs have advanced during the investigation and have alleviated the initial graphical performance issues, it is possible to create a targeted fidelity tactics trainer for support helicopters using COTS at a significantly lower cost than traditional methods, and development timelines using COTS are dramatically reduced compared to traditional simulation methods.

5.14 M&S Center of Excellence by COL Francesco Mastrorosa

COL Francesco Mastrorosa gave a presentation on NATO's Modeling & Simulation Center of Excellence. He explained the relationships between the M&S COE and other agencies in the NATO organization. He

reviewed the M&S COE mission and goals. COL Mastrorosa described the M&S COE facilities and the organization of the staff manning the COE. His presentation included numerous pictures of the facilities including mock-up diagrams of rooms still under construction. COL Mastrorosa explained the COE Accreditation Roadmap and where the M&S COE was in the process with an anticipated M&S COE Accreditation of December 2011. He described the four core areas of the M&S COE as: support to NATO and the Nations, additional support to the Nations, collaborative relationships with industry, and collaborative relationships with academia. COL Mastrorosa described the M&S COE's possible priorities of work within the areas of training, analysis and lessons learned, concept development and experimentation, and doctrine and standards. Finally, COL Mastrorosa explained the benefits of joining the M&S COE. Following his presentation, he led the group on a tour of the facility.

6. CONCLUSION AND RECOMMENDATIONS:

6.1 Central themes throughout the workshop:

During the course of the workshop several themes or key issues arose sparking much discussion including:

- Definitions – Paul Thurkettle stated that names are important. Numerous times, presenters brought up the issue of what constitutes a virtual world.
- 2D or 3D? – The group discussed, during several presentations, whether or not 3D was a required component of a virtual world or game to be immersive. It was agreed upon by the participants of the workshop that 3D is not required.
- Persistence – Some in the community state that persistence is a required component of a virtual world. Many at the workshop disagreed with that particular statement.
- Contracting and Request for Proposal language – Related to the definitions issue, several presenters, both government and industry, highlighted that government RFPs may be limiting a potential valuable solution by specifically requiring a virtual world or a game.

6.2 Workshop position regarding definitions; serious games, virtual worlds, massive multiplayer online games.

As an emerging suite of education and training technologies it is clear that these experiential-based learning tools should be simply categorized as immersive technology. That is to say that the participants are required to take on a particular role within a scenario that causes them to achieve a degree of presence that enables meaningful achievement of specific objectives.

There was a general consensus at the meeting that additional labels of the type listed above were artifacts based upon the need for vendors and early adopters to communicate meaningfully about initial capabilities that have evolved significantly since they were first applied. It is likely that these terms will endure as they are imbedded in the names of some products and even organizations. However, it is agreed that the family of immersive technologies discussed during this workshop has considerable overlap in terms of their applications and as a result, using the initial classification scheme in requirements documentation is likely to artificially limit the ability of vendors to participate in the competitive process.

Sample Requirement statement: Using immersive technology running on this *type of computer system* provide experience-based training to allow trainees to demonstrate that they have achieved a specific level of language capability.

6.3 Conclusion

With the aim of the workshop to share national experiences, explore commercial and games technologies, understand best practices, and to identify barriers to further exploitation and ways these barriers might be overcome; and then to investigate issues surrounding virtual worlds and similar technologies as they apply to using these technologies in military applications, the workshop was a success. There was much discussion involving the entire group on these issues. Particularly notable is the position statement that was crafted by Dr. Roman based on his observations of the debates and agreed upon by all at the workshop.

6.4 Recommendation

- MSG-093 represents a logical progression from discussions of only serious games to including new technologies called virtual worlds and immersive environments. This series of workshops should continue to progress and perhaps involve topics such as mobile device delivery means.
- Continue to sponsor and conduct the Exploiting Commercial Gaming and Technology for Military Use workshops as it provides an enterprise view of new technology as well as individual nation's applications of them. Using workshops in this manner facilitate NATO and ACT's role in standards, interoperability, and best practices as well as highlighting new technologies.
- Continue to be an example in the application of new technologies by offering a distributed, collaborative means to participate in the conference from remote locations.
- Utilize the M&S COE facility as the meeting place for the workshop. The facilities are well suited for this type of workshop. Additionally, the staff of the M&S COE benefits by maximum participation in the workshop.

MSG-108 - Exploiting Commercial Games and Technology for Military Use
10th Workshop
(STO-MP-MSG-108)

Executive Summary

Objective of the Workshop

The commercial sector is developing many of the key technologies and applications that have the potential for cost-effective adaptation for defence exploitation and use in modelling and simulation (M&S) applications such as defence planning, training, operations and capabilities development the immediate focus is training. The exploitation of commercial technologies and appropriate use of open standards can provide efficiencies and increased benefits for defence applications. There is a need to identify those technologies having the greatest near term potential and understand the future trends and developments in those technologies that have potential to meet future defence requirements.

Past workshops have shown that there are a range of issues associated with employing commercial technologies. Attempts to focus on particular aspects of commercial technologies have not been particularly successful. Usually discussion of issues has resulted in briefings and discussions on individual research and progress in individual nations and industries. The result has concentrated on the near term lessons identified from the exploitation of these technologies and the organisers now wish to focus on a future vision.

Conduct of the Workshop

MSG-108 was conducted 25-28 October 2011 at the QinetiQ Facility in Farnborough England. The workshop was attended by 45 invited ACT, NATO national representatives, and industry personnel participating in 13 presentations concluding in discussion of high interest topics. The workshop was distributed via Harmony Web for remote participants.

Conclusion

With the aim of the workshop to provide a venue to explore through demonstrations and presentations the "road map" related to exploiting commercial games and technology, to provide updates on the nations' current application of commercial technologies, and to provide capability briefings was a success. Developments of a technology "road map", while asked throughout the workshop, were highlighted during the syndicate's panel discussion at the end. The open panel discussion was one of the most beneficial portions of the workshop as it provided the mechanism for the participants to begin to shape the "road map" into manageable topics for further discussion at future workshops.

It is clear that NATO nations are currently using commercial games and technologies, and based on the remarks from the group, there is a need and a desire to continue to pursue commercial games and technology solutions even given current procurement guidelines. NATO and ACT have the organizational infrastructure to facilitate these types of workshops and should continue them.

Exploiting Commercial Games and Technology for Military Use – Technical Evaluator's Report

1.0 SUMMARY OF PROCEEDINGS

Purpose: The purpose of this summary of proceedings is to document the NATO Modelling & Simulation Group (NMSG) MSG-108 Workshop on Exploiting Commercial Games and Technology for Military Use

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2.0 OBJECTIVE OF THE WORKSHOP:

As with past workshops, this workshop is being planned to share national experiences, explore commercial and games technologies, understand best practices, and to identify barriers to further exploitation and ways these might be overcome. As well, this workshop will attempt to articulate a technology road map for the possible future of commercial technologies and games.

3.0 3. WORKSHOP AGENDA

Tuesday 25 Oct 2011

1300	Administration
1320	Welcome and Introductions
1400	Stu Armstrong Wayne Buck "COTSUE Latest Issues M&S State of Play in ACT"
1440	Andy Fawkes "A CapJTES Update
1520	Administration
1540	Frank Anders Developing good-enough War-games and research on Gaming the game
1620	Karl Johan Simonsen Danish use of Commercial Games
1640	Chairmen "Daily Recap Daily Adieu"

Wednesday 26 Oct 2011

0845	Administration
0900	Recap from Day 1
0920	Pete Morrison, Bohemia Interactive The Battlefield 3 Effect: Do graphics matter for Serious Games?
0950	Jerry Heneghan, HumanSim "HumanSim and other stuff

1020	Administration	
1100	Johnny Garcia, SimIS Inc	Next Generation LVC Architecture
1140	Bob Hayes, Microsoft Fellow	getting ahead of the game!
1220	Administration	Lunch
1300	Graham Longley-Brown	"LBS Consultancy
1330	Hilde Hafnor	"Joint 2013" An Exploring Activity
1400	Prof Agostino Bruzzone, Genoa	Simulation Team Happenings
1440	Paul Thurkettle, HQ SACT	"Immersive Environments Implementation
1520	Administration	
1540	Richard Radmacher, Havoc	Using games technologies for training and simulation
1620	"Stu Armstrong Wayne Buck"	An Introduction to a Possible Future
1630	All	"Daily Recap Daily Adieu"

Thursday 27 Oct 2011

0845	Administration	
0900	Recap from Day 2	
0920	Syndicate Work	Brainstorm the Future
1000	Syndicate Work	Brainstorm the Future
1040	Administration	
1100	Syndicates	Syndicates Present
1140	Debate probable future	
1220	Adieu	

4.0 PARTICIPANTS

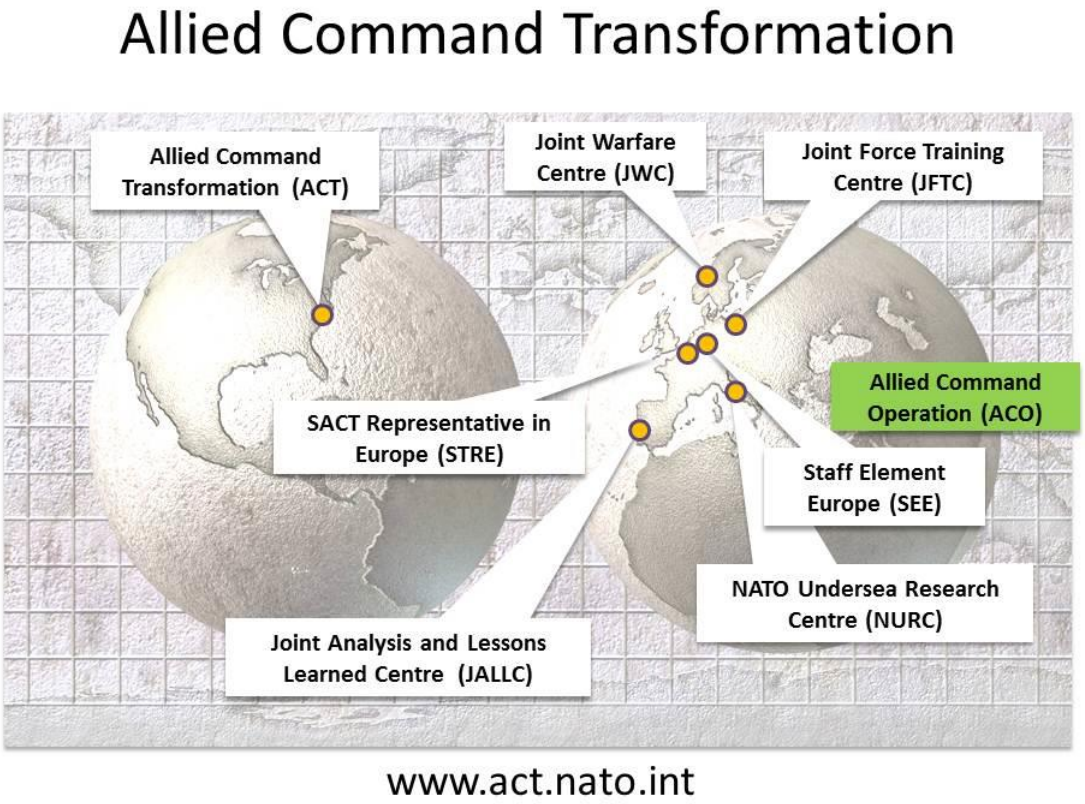
Stu Armstrong	Wayne Buck	Jim Flaherty
		Jim Carr
	Marcus Dahlberg	Jan Ward
	MG Skare	Staffan Granberg
	Nico Bau	Robert Virding
	Roger Schane	LTC Vincenzo Calicchio
	Roy McNee	LTC Jan Beaumont
	Johannes Denijs	Major Jeremy MacDonald
	LTC Christian Bell	Clark Rich
	LTC Eriks Naglis	David Unrau
	Maj Richard Nowinski	Curtiss Murphy
	LTC JP Cormier	Dan Henkel

	LTC Istvan Ocskay	Colin Bigg
Peter Morrison	Murray Taylor	Jacek Sumislawski
Stacy Elliott	Eric Pouliquen	Walter Hader
Michael Emonts	CAPT Carlos Alberto Belinchon Pinedo	Maj Kuido Pettai
Julien Mallet	Gianluca De Leo	Jens Malmquist
Amy Grom	Col Andrea Solymar	Geoff Johnston
Doug Whatley	Dan Berry	LTC Mike Patchett
Bharat Patel	RADM Christian Canova	Maj Geoff Smith
Andrew Brown	Nathan Carreiro	Joe Armstrong
MSGT Cleon Skeete	Jaymie Caplen	

5.0 EXECUTIVE SUMMARY OF PRESENTATIONS:

5.1 Opening remarks by Wayne Buck and Stu Armstrong

Mr Buck provided an update to the audience on ACT happenings and ACT's role as NATO's leading agent for change, driving, facilitating, and advocating continuous improvement of Alliance capabilities to maintain and enhance the military relevance and effectiveness of the Alliance as shown in figure below.



Mr Buck further discussed areas that are benefiting from immersive technologies like:

- Meeting & Collaboration
- Rapid Prototyping
- Training & Education
- Skill building
- Data Visualization & Analysis
- Outreach

He further discussed Village Survey, Virtual Worlds and Borders Ahoy. He further discussed D54 Incorporation of Technological Advances through Modelling and Simulation strategic Decision making Training through games. Mr Buck discussed the M&S Centre of Excellence in Rome and its uses of Doctrine, concept development, lessons learned and training.

He discussed the ACT supported NMSG's for 2011:

- MSG-068 NATO Education and Training Network - Chair (JWC)
- MSG-084 Master Plan Update Co-Chair
- MSG-087 NMSG Symposium – Paper Presenter
- MSG-091 Identification of C2 M&S Gaps
- MSG-102 Simulation in Support of Operations - Chair
- MSG-103 NMSG Exploiting the COE (3) Co-Chair
- MSG-104 Simulation in Support of Operations Co-Chair
- MSG-105 Define the Support to Exercises … Co-Chair
- MSG-106 CAX Architectures … Co-Chair
- MSG-107 Human Factors in Military Training Co-Chair
- NSG-108 Exploiting Commercial Technologies Co-Chair
- MSG-ET-030 Interoperability Requirements for Immersive Environments – Chair
- MORS - Chair

Mr Buck further discussed the need to leverage MSG-108 as a forum to continue collaboration and he plans to conduct 2 more workshops in 2012.

5.2 Stu Armstrong on UK Research – QinetiQ – COTS

Mr Stu Armstrong provided a presentation on Research Areas that QinetiQ is conduting as it relates to commercial games he gave a quick review of the following:

- Horizon Scanning
  - Emerging technologies that haven't yet been commercialised
- Technology Quick Looks
  - Short investigation into commercial technologies
- Technical Demonstrators

- Purpose built technology demonstrations to meet a customer need
- Used to capture lessons on technology exploitation
- More frequently used to capture evidence to support business case

Mr Armstrong discussed that Synthetic training could save 100-600 million pounds a year. He further discussed the need for MOD to have a plug and play architecture as it relates to simulation and gaming. He gave more ideas on other capabilities within gaming as it relates to game theory, Cultural training and how to use Training and transformation architectures. Mr Armstrong further discussed the support of web enabled immersive environments like avatars levels of interoperability and training application for augmented reality – live fire against virtual targets.

5.3 Andy Fawkes Deputy Head of capability, Joint Training Evaluation and Simulation (JTES) – Transforming Defence Training through Technology

Mr Andy Fawkes provided a presentation on how the UK MoD is transforming Defence Training through technology. Mr Fawkes mentioned that the requirement for simulation is not a new requirement and the need for simulation and modeling has gone as far back as the early 1900's with the modeling of airplanes to development of gaming technologies that leverage the tenants of M&S. Mr Fawkes showed a video from 10 years ago – half life from 1998 – really involved in training – we are still saying that gaming is new when we have been doing it for over 15 years now. My Fawkes articulated in his presentation that - "This is not a serious game this is serious training". He also discussed the trends in Simulation technology trends that enable change from mechanical in the 1980's, Bespoke in 2005 to Commodity in 2011 and Cloud thereafter. He provided and discussed a chart on numbers of trainees using simulation and 3D worlds from the 1990's to today from a few pilots to 100's of thousands. His point of the chart was that MoD and Defence is not driving innovation other industries like the entertainment industry has developed simulators that the Defence industry repurposed for pilot training. Mr Fawkes also mentioned that the UK MoD spent 7.2 billion on training which is almost 20 percent of the MoD annual budget. He want as far as showing 3 key benefits of simulation:

- Improve Training Effectiveness
  - Simulation is ideally suited to training "thinking skills"
  - The optimum blend of simulation and live training enhances overall training
- Reduce Defence Costs
  - Training in simulation is typically 5-20% cost of live training
  - A 25% transfer of live training to simulation could save 10% of the overall cost of training
- Reduce Defence Environmental Impact
  - Defence's total CO2 Emissions are 2.7 times that emitted by all domestic UK aviation (5.6m tonnes)
  - Reduce disturbance on local populations and impact on training areas

Mr Fawkes recommended that "Defence should embrace a step change in its exploitation of modern Simulation Training systems, driven by explicit targets for adoption, and supported by an enterprise focus on driving down the barriers to acquisition and use."

Mr Fawkes provided some insights where the MoD is seeking a Common Simulation Infrastructure as Driver for Change:

- Common Network
  - Enable Distributed Collective Training:- Single Service, Joint and Coalition
  - Provide Access to Common Services
- Common Simulation Software
  - Set of Common PC-based Software meets most Defence User's Needs
  - Common CGF, visuals etc
  - Interoperability, reuse and cost effectiveness "out of the box"
- Common Simulation Data
  - Terrain, Equipment/Platform Characteristics
- Common Tools
  - Common AAR/Debriefing etc tools to facilitate distributed collective training

Mr Fawkes provided great insights on the MoD's use and need of simulation for a Blended Training solution seeking the right balance between live and synthetic training with the use of commercial "credible" gaming technology.

5.4 Anders Frank– Sweden National Defence College – Developing good-enough Wargames Low Fidelity wargames for high quality education.

Mr. Frank provided a presentation on the uses of war-games at the Sweden National Defense with the focus on fidelity of training in particular uses of transformational capabilities (wargame research) to a new complex and global environment. Swedish armed forces Wargame research program focused on wargaming activities with low transaction costs, Theories of wargaming and Game Studies (commercial games domain). Some of the findings presented showed that low fidelity gaming is well suited for high level training as shown in figure 1 below.

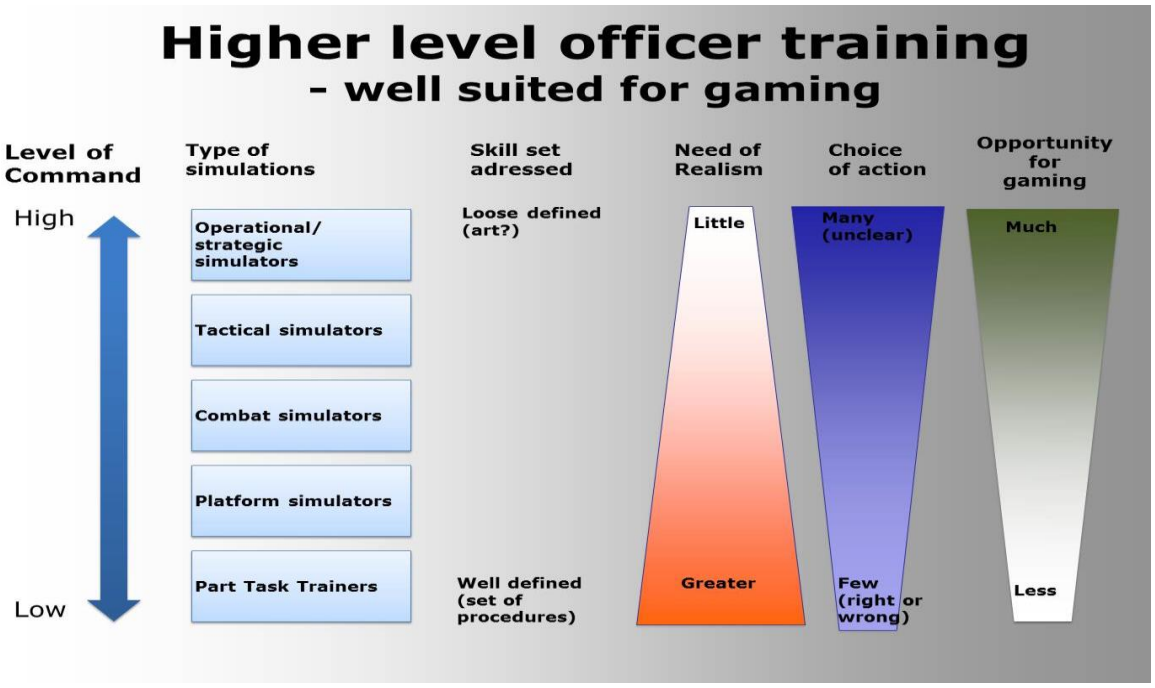


Figure 1 Swedish Defense Research on Gaming

Mr Frank provided one of the better quotes of the workshop ”A [good] game is a series of interesting choices” – Sid Meier. Mr Frank also mentioned that Games and gaming (more) easily lend itself to a problem space characterized by many choices but especially in Sweden where capabilities that are “good enough” are used for intended purpose. He basically wanted to show how using low fidelity games simplify training by Capture major attributes of warfare without trying to encapsulate all details focused on aspects of warfare and purpose. The first pilot was a Cadet course in naval and amphibious warfare that showed basic tactics and test the plan under a tight time line and tight budgets. Mr Frank discussed concerns and issues with low fidelity games:

- Maintaining students suspension of disbelief
- Over-enthusiastic teams **“Gamer mode”**
- Not given enough time for iterative use
- The essential and delicate relation of gaming and debriefing

He provided a definition of “gamer mode” as - A player attitude where the game goals take precedence over the learning goals and player behavior becomes rational with respect to game rules but irrational with respect to the corresponding real-life situation.”

As part of this part of the presentation Mr Frank described research conducted to show that “gamer mode” shows the following symptoms:

1) **Will to win, competition.**
2) **Symptoms in military educational wargaming**
   - Increased risk tendency
   - Short term goals
   - Reactive behavior
   - All units are engaged, even though they are not needed to
   - Unethical considerations
   - Game goals become predominant.
3) **Many face’s and perhaps too harsh to say Gamer Mode is all bad.**
   - Depends on audience, learning objective and situation.

Mr Frank went on to discuss the approach to making a methodological shift for games and learning:

1) From isolating the artifact
2) …to media effects…….
3) …to the context where it is used.
4) Learning is seen emanating from the players when interacting with the game

In conclusion Mr Frank provided evidence that gaming in a military environment was successful as long as the game is placed in context, is a natural part of the course and the students are familiar with the theme of the game.

5.5 Karl Johan Simonsen – Danish Defence Acquisition and logistics Organization- Danish use of commercial games.

Mr Simonsen provided an excellent presentation on the Danish use of commercial games. He provided examples of simulation models and serious games used for events:

1) Steel Beasts Pro
    a) Tactical trainer (Squad to Company size exercises)
    b) Platoon Trainer (Leopard 2A5)
    c) Crew Trainer (Leopard 2A5 , OHW)
2) VBS2
    d) Video Feed from UAV (BDE / DIV staff exercises, JCATS)
3) IFACTS
    e) FAC trainer
4) IRAS*Comm / IRAS*Trainer
    f) Simulated radios (eg. Intercom)
5) JCATS

Basic connection to BMS / C2 systems – needed in order to "Train as we Fight"
Mr Simonsen provided an example of a simulation gateway to Danish Army BMS / C2 Systems integration using gaming technologies and simulated radios. The results of this events proved that simulated training and games save ammunition and efficient use of capabilities. Plan for C2 and Simulation full integration will leverage MSG-085 with BML

Wednesday Oct 26th 2011

5.6 Pete Morrison Bohemia Interactive -

Did not share his slides for this presentation –

Mr. Morrison started his presentation with a movie trailer for 'Operation Arrowhead', a commercial game to be used in conjunction with the commercial game 'ARMA.' The theme of Mr. Morrison's presentation was that fundamentally what was important to him and his company was providing measurable training value to users of the VBS (Virtual Battle Field Systems) technology. Morrison stated, 'although photo realistic graphics are one of the least important requirements for military training, however glitz and graphics sizzle are what sell games for interactive entertainment.'

To support his assertion, Mr. Morrison referenced a book by Dennis A. Vincenzi called: ***Human Factors in Simulation and Training*** in which Vincenzi states that 'visual fidelity is expensive' and 'reaching the point of diminishing returns with increased graphics fidelity is certainly possible.'

Mr. Morrison showed graphics images from VBS 2 (~2007) and stated that trying to attain the same graphical fidelity that games have requires five times more resources now than when VBS2 was released. He stated that a big key to the success of the VBS2 portfolio is the amount of customization that is possible with the editing toolset embedded in the applications. According to Morrison, other success factors include having used small team for development, a successful business model (selling via enterprise licenses vs. single seat licenses) and end user acceptance in several military organizations around the world.

Morrison concluded by referencing an open solicitation, released on Oct. 13, 2011 valued at $25 million for the U.S. Army called 'Games for Training.' Morrison stated that this opportunity would be hotly competed among multiple qualified vendors and that he was surprised at the emphasis on graphics in the U.S. Army solicitation description. See:
https://www.fbo.gov/index?s=opportunity&mode=form&id=3577a466e567d4a589656af708bcde70&tab=core&_cview=1

Increased training capability –

Graphics = "visual fidelity"

5.7 Jerry Heneghan – HumanSim For medical education and training

5.8 Dr. Johnny Garcia – CEO SimIS Inc. – Next Generation Architectures – commercial games

Dr. Garcia provided a presentation of the ACT M&S Vision and Next Generation Modeling and Simulation Architectures.

What is the ACT M&S Vision "*exploit M&S to support NATO transformation wherever it can enhance capability, increase interoperability, save resources or reduce risk in the application areas of training, operations, defence planning and capability development"*.

Dr. Garcia provided a chart of NATO stakeholders and explained the difficulty NATO has in supporting this vision as it relates to support, coordination, and requirements for Modelling and Simulation throughout NATO in particular:

- Promote the sharing of tools, data, and information across the enterprise
- Foster common formats
- Are readily accessible and reliable
- Promote interoperability and the use of common M&S capabilities
- Minimize duplication and encourage reuse of M&S capabilities
- Encourage research and development to respond to emerging challenges
- Limit the use of models and data encumbered by proprietary restrictions
- Leverage M&S capabilities across international partners, industry, and academia.
- Support the full range of NATO and national interests

Dr. Garcia then discussed Next Generation Live Virtual and Constructive Architectures. He started with the current challenges of current LVC environments:

- Federation becoming increasingly large and unmanageable
- Costs increasing to upgrade existing and new federate additions
- Resource-intensive integration of new federates and support
- Tightly-coupled simulations
- Bridges and gateways often required to integrate new and emerging technologies
- Many redundancies and inconsistencies in data representation

He then talked about the next generation LVC architecture as a capability to conduct:

- Rapidly utilize real-world source data
  - Cloud-based Rapid Data Generation (RDG) and distribution capability
  - Support operational COA development
  - Support Concept Development with Training
- Abstract User Interfaces to lower the barrier to use

    - Invoke only services needed by user
    - On demand access to scenario repositories
    - Users interact with common terms and symbols (Military & Civilian systems)
    - Interact with C2 systems
- Make simulations smarter / more capable
    - Open Architecture Principles
    - Navigate terrain / interpret physical environment and effects
    - Attempt to apply orders more effectively
    - Allow faster than real-time simulation without intervention
    - Dynamic Intelligent Control Agent (scalable in cloud)
    - Reduce role-player dependency

Dr. Garcia then discussed the need to shift the paradigm of M&S as it relates to training, experimentation, Analysis – "we need to stop putting M&S in a category by itself it needs to be an operational capability" Dr. Garcia then recommended some changes to leverage commercial games that would enable better transformation of NATO operations:

- Develop Business Models –
    - Government
    - Industry
- Large vs. small business
- Changing environment
    - Governments and industry going to adapt?
- Show me the goods "government desire to see the games in action"

5.9 Robert Hayes – Being ahead of the Game.

Microsoft institute of

MSI –

Technology trends –

The internet of things –

Relies on two things – information services accessed from the cloud.

Services accessed on a variety of devices – handheld – etc

The cloud

Criminals are using these things to do crimes using clouds for this –

Migration of Data to the cloud.

No data center in UK.

Cloud based services

Gave a based service that follows the person where there tweets are coming from. This is a C2 capability. It mapping this information

Looking at data that is contextual to the person searching for that data.

Application

Tweetheat –

Flicr and MS Bing

Windows live the platform

Kinect – story how it came up – computer vision folks with object recognition – alternative way of working with the connect sensor.

Avatar Kinect.

Kinect Fusion – WOW

Camera is software coded – june released an SDK for the non-commercial sector will release and SDK for commercial in 2012.

Distribution and networking

How many people know this exists – unknown

Location of services that don't know where the data is going. Pedigree of data – who owns it and trade controls.

Defense is not driving any of the technology – how does significant in the ESP – services will remain around – engagement is the way to leverage the technology. MOD – is not aware of what goes on in the geo-space. Third-party is the approach with small and medium enterprise

5.10 Graham Longley-Brown M&S Issues challenges and recurring errors.

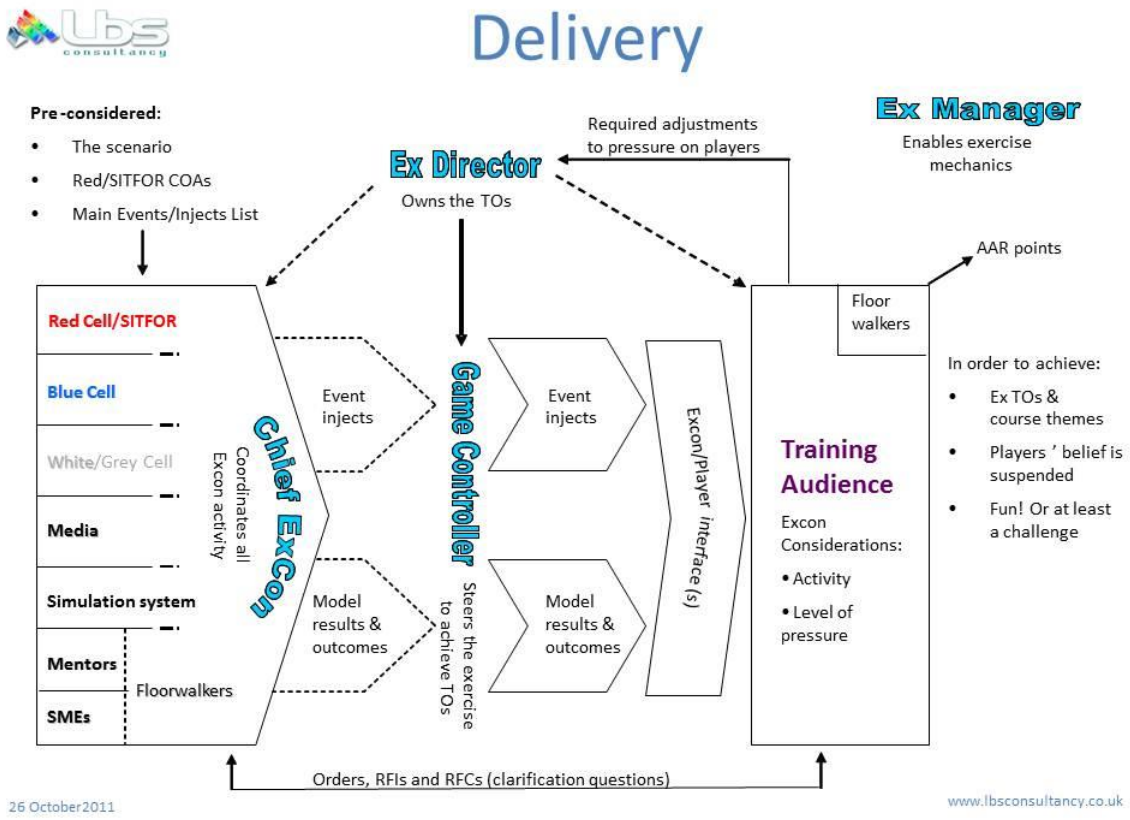
Mr Brown provided a presentation on To present issues, challenges and recurring errors made when designing and delivering simulation-based training and analytical events. He wanted to make sure the audience understood the definition of scenario: "*'The background story that describes the historical, political, military, economic, cultural, humanitarian and legal events and circumstances that have led to the specific current exercise crisis or conflict. The scenario is designed to support exercise and training objectives and, like the setting, can be real, fictionalised or synthetic as is appropriate. A scenario will be composed of specific modules, event and inject serials and technical data essential to the accomplishment of the exercise objectives or of the seminar/academic/experiment objectives."*

Wargame: "*'A simulation, by whatever means, of a military operation involving two or more opposing forces, using rules, data, and procedures designed to depict an actual or assumed real life situation.'*

Mr Brown wanted to get his point across that its all driven by the process of design or the 'The successful conduct of a CAX depends more on the correct composition of exercise components (Ex Control, Ex Support and Training Audience) than on the efficient tackling of technical issues'.

Erdal Çayirci. 'Computer Assisted Exercises: A Reference Guide', p.16

In conclusion as shown in figure below Mr Brown was described the need to control training environments with agreed to definitions, distinctions design and delivery.



5.11 Hilde Hafnor –

JOINT 2013 "an exploring activity" Norwegian Defense" helping the way people think and work together.

Focus is to develop a new contact for network based military training – the ability to collaborate.

Background of the pilot – joint 2013 was established

Key elements of the methodology for the design of the concept – leverage gaming solutions for collaboration,

Balancing Joint

5.12 Dr. Agostino Bruzzone – university of Genoa The Potential of Reusing

Serious Games Engine from Business to Homeland Security.

Dr. Bruzzone provided a great presentation on the uses of serious games for homeland security. He gave the workshop a brief description of who the research team is from a range of Universities, Research Centers and Companies operating worldwide in synergy for developing Innovative Solutions with a particular focus in Modelling and Simulation.

He further described SIBILLA which is a Serious Multi-Player Web Game for teaching on cooperative and competitive environment of distributed teams (i.e. prevention and intelligence against terrorists):

Why to use Serious Games:

- "Serious game is a term used to refer to a software or hardware application developed with game technology and game design principles for a primary purpose other than pure entertainment. Serious games include games used for educational, persuasive, political, or health purposes.
- Serious Games provide an opportunity to improve performances with reduced efforts to professional simulation with great attention to Interfaces, Graphics, Scenography and

He then described major issues on serious game framework from:

- Professional People "Talking with" Game Developers
- Professional Software "integrated with "Game Engines"
- Professional Hardware "vs." Game Devices
- Scenario Definition "vs." Game Level
- High Fidelity "vs." High Physics
- Training "vs." Playing
- Cost/Unit: High "vs." Low
- Few Users "vs." Many Users

Dr. Bruzzone further discussed the coupling of human behavior in serious games:

- Serious Games usually have a Stronghold in Graphics, Usability, Interfaces and Multiplayer capabilities.
- Games Frameworks needs to guarantee proper Fidelity and correct Models for their specific Purpose
- The potential application areas usually introduce the necessity to add Artificial Intelligence (AI) able to add realism by introducing Human Behaviors and Intelligent Agents (IA)

He further discussed human modeling challenges as they relate to rational decision making and instinctive and emotional behaviors. He also defined human behavior Simulation is the reproduction of the Humans by using computer models. Usually this requires simulating aspects related to Emotions, Rational Thinking, Psychology, Ethology and Sociology with the detail required by the specific Modeling & Simulation Project.

Dr. Bruzzone concluded that Multiplayer Games introduce new opportunities for Serious Applications integrated with Intelligent Agents

- Human Behavior Models enhance this potential providing new Opportunities
- There is a great potential in using Serious Game as technology enabler to enlarge Installations, User Community and Utilization Modes
- It critical to define reference baseline for fidelity and detail level that characterize Serious Games considering the expected benefits and use modes.

5.13 Paul Thurkettle HQ SACT Immersive Environments

Mr Thurkettle provided a brief on the Present and future technology to support Education, Training & Exercises in NATO, dreams and practicalities. He discussed where we are today as it relates to NATO ACT. Mr Thurkettle talked about training technologies "inside the NATO box" of Advanced Distributed Learning – Servers on all NATO networks – over 25,000 users completed online courses developed to SCORM Standards. NATO leverages Blended learning, virtual classrooms online and classroom study and then of course death by PowerPoint. He mentioned the challenges and current issues:

- Increased demand for NATO support throughout the world
- Decreasing resources and funding
- Limited education and training resources
- Multinational (NATO/non NATO nations and Area of Operations (AOR) outside of NATO boundaries
- Younger generation – new learning styles

He mentioned the re-thinking of NATO Education and Training polices:

- Just enough"…"Just when I need it"…"Just in time"
- Provide education and training just before deployment
    - Current knowledge, relevant to mission
    - Realistic mission rehearsal exercises
    - "New Generation ready" – Multigenerational acceptance

Mr Thurkettle showed some examples of integration of live training, man to machine interfaces and how we get there. He mentioned in order to get to these immersive environments we need to have senior leader buy in enters the Joint Force Trainer Role at NATO ACT new post established in 2010:

- Break the "old model of NATO ETE" (Education, Training and Exercises) Re-think the objectives, capabilities and needs. More effective both in cost and achievement.
- Utilise modern technology to assist in:
    - Individual Education and Training (eLearning, Immersive Learning, Mobile Learning, Small Team Training)
    - Collective Training – Distributed Training, Simulation, replication as near as possible of operational situation

NATO has to invest more in idea generation from industry and NATO Panels – "take risks". ACT should leverage its agreements with the likes of Microsoft, IBM, Oracle ….but not much filtering down. NATO accounting & contracting models have to adjust and be flexible (one year advanced notice to buy ***a*** mobile device is ridiculous). Industry has to help the lower levels by less "Smoke and Mirrors" to Generals *"I must have that"* syndrome.

In conclusion Mr Thurkettle mentioned we need to think "Out of the box" on Exercises, *how should we do it"* "not *"this is how we do it". NATO needs to also:*

- No better time in NATO to float new ideas, limited budgets, nations wanting cuts and value for money, willingness to accept changes and collaboration with new systems, interoperability.
- Technology moving faster than NATO can address – change NATO adaptability or freeze in time
- Go beyond MSG / RTA / NTG meetings and have labs and "play time" (Get involved in TIDE SPRINT / CWID)
- Break down the stove pipes that still exist in NATO even within same headquarters C4ISR / ETE / Planning
- **Collaboration, sharing, talking across NATIONS**

5.14 Cory Kumm HAVOK game technologies for Training and simulation

US/Intel owned

Design of middleware – model into defense space……

Possible future for M&S and commercial games 5 years 10 years.

Equate money to quality –

Barrett –

UK – MOD I can't just buy something because its good.

Security obstacle – transformation process.

National perspective and put our money together.

Differences of cultures –

Terrain Generation

UID – more actively

Interoperability – software agnostics

Pinpoint enthusiasm for uses of games technology.

What do we can elite technology – advanced technology – develop the types of effects self enforcing effects of the training….

Recap session.

Government -

6.0 SYNDICATE BREAKOUT

A syndicate session without presentations was formed during the conference to allow open discussion of topics and ideas for NATO Commercial gaming Technologies (Modelling and Simulation). COTS games technology breaks down into many areas. Here we focus on 5 characteristics

1) Network Technology and Architecture
2) Automation of Processes
3) User Interface Devices
4) Interoperability
5) Mobility and Portability

Each characteristic is selected for its relevance and applicability to the four ACT capability domains capabilities related to operations, capability development, training, and defence planning. We also divided the group into 3 distinct groups:

1) Industry
2) Academia
3) Government

6.1 Industry

Syndicate work – Industry

Topic 1 Network Technology & Architecture

1) Sensitive of users and relation to security
2) Commercial technologies – deep approach with using one off compartmentalized durative of this using Commercial Games – possibility of cost savings
3) Empire Strikes Back - the use of latest technology – hologram –
4) Kinect architecture and high fidelity - Hologram of teleporting the security
5) Accreditation applications – how to conduct security certificate of noteworthiness.,…
6) Does NATO have the authority to create a NATO only domain – how could this domain be leveraged to enhance gaming technologies

Topic 2 – Automation of Processes

- Automation of processes as it relates to entertainment
- Rapid generation of terrain – LIDAR
- High fidelity – will have options in the future – the government is lacking whats good enough. How to define what is good enough.
- Adobe photo fly culture divide between military and industry. Interaction between
- Achieving training objectives – "how do we get to where we need to be" – what do you need -
- What is the desired end state – what does success look like.
- Crowd sourcing – HLS dilemma – not taking advantage of those resources…compilation of data – we have not taking advantage of this in the future and industry is driving the – content generation (Microsoft – Google ETC).
- Who should drive technology/implement – Industry or Government – Industry develops the technology and government develops the fit for purpose-
- Processes – TRL enhancement
- What is the role of Government – should not be developing games for funding opportunities

Topic 3 – User Interfaces Devices

- Clouds – what about interfaces for hardware not just software
- Head ups displays –
- Gaming industry has driven the UID evolution –
- Disabled soldiers use of UID's – go back on active duty
- Multi-touch -

Topic 4 – Interoperability

- Issues – with gaming – propriety to protect content
- Platforms are web-browsers the natural interface to the mobile devices (ipad, slates etc)
- Go from interfaces –
- research when you lose something from a big screen to
- NATO M&S profile –
- Create a gaming standards profile as an addendum NATO M&S profile.
- Composability – models from information based to knowledge based analysis

Topic 5– Mobility and Portability

- With the use smart phone – development of solutions
- Conveniences which enables operations
- Encourage open systems – game technology –
- Mobile devices are good for personal training
- Not good for team training today.
- Strategic messaging – how do we use technology with people who cant read – Information warfare (IW)
    - Natural language translation.
    - Culture Awareness
    - AIDS ETC.

META Ideas

1) Cognitive tasks –
2) Human interfaces-
3) Autonomous interfaces
4) Model Based Data engineering
5) Cultures – immerse senior leaders in a culture in order to make analysis 2-3rd orders effect – awareness to think multi-awareness

6.2 Academia

Syndicate work – Academia

Topic 1 Network Technology & Architecture

- Nobody here from the security perspective which could be the real obstacle for further exploitation.
- We are and live in a classified world
- Approaching the systems (making use of commercial technology) more modular or as layers stepping out to more open system as we move further from the core.
- Start talking to change people, security people to get them involved early on in the process.
- You can either do it by yourself or be in bed with the industry and thus be involved.
- Perhaps we need to leave the national perspective and spend our research and development money together with other countries to solve security and architecture challenges.

Topic 2 – Automation of Processes

- Many of the goals within the AI community can be solved by just playing together in a multiplayer environment. For instance regarding cultural awareness the real goal is not to learn about a specific culture but learn that it **is** a difference between cultures.
- Higher fidelity does not necessarily lead to more training. This is an insight we need to communicate to customers and stakeholders by for instance educate them. To make them aware of the differences between verification and validation. And that validation is just relative to the intended purpose.
- As of terrain generation – sit back and enjoy the ride. Many organization and industries outside the military are interested in driving change to make terrain generation possible. The only question left for us is to make use of this and understand where and how to put in military sensitive data to the terrain.

Topic 3 – User Interfaces Devices

- More **actively** follow the industry developments. For instance start talking to Microsoft before they release the next SDK to their products and start development on specific solutions to minimize loss of time.

Topic 4 – Interoperability

- The drive got to be software agnostic
- Interoperable is highly engineered driven which tries to pinpoint an anticipated effect. But what exactly value are they talking about? Can we really talk of interoperability as value added on a general level?

META LEVEL comments

- The real challenge is to make the defence sector more adaptive to changes. The perhaps new technologies and trends from the commercial games industry will be more easily exploited and used.
- Incentives for technology and cultural change need to be above the problems associated with the hierarchical command systems. Does it matter who carries a message for use of new technology?

- We need to address the real enthusiasts and encourage them. Support them and study their uses and make use of their competencies elsewhere where it is applicable. This will generate best practices and ease of transfer this experiences.
- Hire technology savvy people to important positions (i.e. close to customers and M&S use). Then magic can happen as they can leverage new uses of M&S to their particular domain.
- Work toward making M&S be an integral part to all military activities.
- Stop spending a lot of money on a few people and spend a lot of money on many people. Games and gaming and other commercial available tools can be used for this purpose.
- Hire programmers to develop modules and or middleware solutions **inspired** by developments and trends from the commercial games industry. Or the will make the necessary **changes** to existing products to fit the military purposes. Real enthusiasts can be fostered by this approach and as above, best practices, can be brought form this.

6.3 Government

Syndicate work – Government

Topic 1 Network Technology & Architecture

- Will we reach a limit ?
  - No - New technology 3G/4G/GSM - Wireless improvements
- Physical- Mainframe/backbone always hardwired but all substations wireless
- Communication – "pingers" transponders linking people / objects together
- Security - Cloud (Huge change in policy / international law Less physical secuirty at the workplace home as dumb device but more required at cloud and encryption. "Degree of trust"
- Accreditation : Human embedded chip, body reconition, less password more physical (DNA?)

Topic 2 – Automation of Processes

- Terrain – UAV will create "on the fly" terrain mapping. Less development time , less human other than "sensible" checking.
- 3d Model – Automatic process – Kenect, scanners, Imax type mapping device.
- Scenario – Computer assisted less human in the loop, real or mythical
- AI – limited Value creates a "uncontrolled" element in the situation, human interventation required, new trends player on player, system can learn from real players to build AI

Topic 3 – User Interfaces Devices

- Interactive – "Holodeck" Can feel, touch, medical virtual patient you work on, suits that give feedback.
- Inputs – Brain control "Firefox", "Think and do" Stephen Hawkings, better interface, Voice Control (computer, house, car)
- Outputs – Immersive headsets, "HAL", All senses included in feedback.

Topic 4 – Interoperability

- Communication Standards – Never get single standards but middleware required to translate.
- Language Standardization - Possible if requirements are clear during procurement, agree on doctrine in international world.
- System Architecture – SOA Server orientated Architecture, try and stay to same methods
- International agreement , naming convention. Repositories, "open source model"

Topic 4 – Mobility and Portability

- Reliability - huge danger of loss of information "all eggs in one basket" weakest point of failure. Use commercial practices for safeguarding / backup
- Performance - Better hardware but networking and point of failure raised, reliability on wireless "lost if unavailable"
- Security – as before increased dependability on security to allow us to operate, will they?
- Quantity growing, will it be condensed or reach saturization?
- Power – Better batteries, physical power , solar, ability not to need to plug in. When battery fails "lost"

7.0 CONCLUSION AND RECOMMENDATIONS

7.1 Central Themes throughout the workshop

During the course of the workshop, several themes or "hard questions" were identified including:

7.2 Conclusion

With the aim of the workshop to provide a venue to explore through and develop a commercial games roadmap for NATO related to exploiting commercial games and technology, to provide updates on the nations' current application of commercial technologies, and to provide capability briefings and demonstrations of commercial technologies with immediate potential for use in a distributed manner through VTC, virtual worlds or other means then the workshop was a success. The only objective not met was to conduct a plug-up using a common multi-national scenario. Most of the hard questions, while asked throughout the workshop, were highlighted during the open panel discussion at the end. The open panel discussion was one of the most beneficial portions of the workshop as it provided the mechanism for the participants to begin to shape the "hard questions" into manageable topics for further discussion at future workshops.

It is clear that NATO nations are currently using commercial games and technologies, and based on the remarks from the group, there is a need and a desire to continue to pursue commercial games and technology solutions even given current procurement guidelines. NATO and ACT have the organizational infrastructure to facilitate these types of workshops and should continue them.

7.3 Recommendations

- For future Exploiting Commercial Gaming and Technology for Military Use workshops, analyze the outcomes / unanswered issues from this workshop to shape the agenda and presentations of the next workshop.

- Continue to sponsor and conduct the Exploiting Commercial Gaming and Technology for Military Use workshops as it provides an enterprise view of new games and technology as well as individual nation's applications of them. Using workshops in this manner facilitate NATO and ACT's role in standards, interoperability, and best practices as well as highlighting new technologies.
- Use the NATO Research and Technology Organization to cast a wider net for participation amongst the countries not represented at the workshop.
- Develop a deliberate plan to conduct a plug-up of the latest commercial games and technologies within the NATO M&S roadmap to offer opportunities to innovative companies while providing valuable information to national representatives.
- Develop a mechanism to involve academia into the agenda for future workshops. Numerous academic institutions are developing new and innovative technologies and techniques and should be included in a public / private workshop such as MSG-108.
- Continue to be an example in the application of new technologies by offering a distributed, collaborative means to participate in the conference from remote locations.

MSG-113 - Exploiting Commercial Games and Technology for Military Use
11th Workshop
(STO-MP-MSG-113)

Executive Summary

Objective of the Workshop

The commercial and government sector is developing many of the key technologies and applications that have the potential for cost-effective adaptation for defense exploitation and use in modelling and simulation (M&S) applications such as Defence planning, training, operations, medical training, manufacturing and capabilities development. The exploitation of commercial and government technologies and appropriate use of open standards can provide efficiencies and increased benefits for NATO applications. There is a need to identify those technologies having the greatest near term potential and understand the future trends and developments in those technologies that have potential to meet future NATO requirements. The technological advancement caused by serious games now includes virtual worlds both of which may have a role to play in support of NATO countries and organizations.

Policy makers such as those at Allied Command Transformation sometimes wonder if the bottom-up implementation of these tools results in the best combination of technology and scalability to improve the effectiveness of operations, training, experimentation and concept development. There are two major challenges to overcome in ensuring the best use of technology and pedagogy. First, the contemporary operating environment is such that training requirements are inherently dynamic and moving fast. Second, there are many tools to choose from but they also are very dynamic and change shape as developers and trainers find new ways to use them. This workshop is intended to develop knowledge and improve understanding on how these tools can best be described, developed and applied in support of military training.

Through discussion and debate, attendees will acquire knowledge and experience in the possible topic areas. Technical and application briefings and demonstrations on selected commercial technology areas will help the attendees better understand the issues so that they may more properly aid in the development of the strategy for the NATO and the Nations to exploit these technologies.

It is expected that all participants will develop a shared understanding of the issues and opportunities.

Conduct of the Workshop

MSG-113 convened from April 16-18, 2012 at the University of Genoa in Genoa Italy. The workshop was attended by 35 invited ACT, NATO national representatives, and industry representatives participating in 12 presentations and concluding in discussions of high interest topics.

Conclusion

Participants and workshop organizers assessed this session of MSG-113 as a complete success. The workshop met its objectives:

- provide demonstrations and presentations to explore supportive of exploitation of commercial games and technologies as it relates to operations, training, experimentation and concept development;
- provide updates on the nations' current application of commercial games and immersive and virtual capabilities;
- provide capability briefings and technical interchange with NATO organizations and NATO partners on success and issues with the implementation of virtual and immersive commercial games within their organizations.

Development of the future of commercial games workshops persisted throughout the workshop and was the highlight of the closing discussions. A final discussion between the chairs and the technical evaluator and host proved to be a most beneficial element of the workshop. It provided the mechanism for participants to begin shaping the future workshops and will be discussed in greater detail in the conclusion section of the report.

MSG 113 showed that NATO partner nations use virtual and immersive technologies for training and experimentation. The workshop participants concluded that a need to continue pursuing these technologies is a must but more actions need to be taken in the validation of technologies, education of user's, and the evaluation of existing acquisition and procurement guidelines.

Finally, NATO and ACT enjoy an organizational infrastructure and innovative partners to facilitate these types of workshops in the future. They should continue to do so.

Workshop 11: Exploiting Commercial Games and Immersive Technology For Use in NATO

Technical Evaluator's Report

Johnny Garcia Ph.D.
SimIS Inc.

Summary of Proceedings

1.0 PURPOSE:

The purpose of this Summary of Proceedings is to document the NATO Modeling & Simulation Group (NMSG) MSG-113 Workshop on Exploiting Commercial Games and Technology for NATO Use. Through discussion and debate, attendees will acquire knowledge and experience in the possible topic areas. Technical and application briefings and demonstrations on selected commercial technology areas will help the attendees better understand the issues so that they may more properly aid in the development of the strategy for the NATO and the Nations to exploit these technologies. The workshop convened from April 16-18, 2012 at the University Genoa Italy:

University Genoa
Villa Cambiaso,
University of Genoa, Genoa, Italy.

2.0 OBJECTIVE OF THE WORKSHOP:

- How immersive technologies are being effectively employed in support of military training.
- Anthologies and/or guidelines that will help policy makers and trainers understand the immersive technologies and how their attributes map to specific training requirements.
- The application of immersive technology in support of decision-making training in kinetic and non-kinetic scenarios for small units.
- The application of immersive technology in support of the training of senior level decision-makers.
- How can instructional designers develop and integrate immersive learning into the formal structural development process for building education and training courses.
- What areas of education and training along with exercises can immersive learning fill, and how can we integrate that into SCORM.
- Creative applications of immersive technology that show promise in support of military training or education.
- Moving beyond training to use these technologies in direct support to operations (battlefield visualization, course of action analysis, mission rehearsal).
- Measuring the level of realism achieved and assessing the degree of immersion and ways to determine how much realism is required to meet specific training requirements.
- Understanding how immersive technologies can be considered as part of the training development process including training needs analysis.

- Cost-effectiveness and return on investment for immersive technology in support of military training and education.
- As with past workshops, this workshop facilitated the sharing of national experiences, exploration of commercial game technologies, understanding of best practices, and identification of barriers and solutions to further exploitation. Additionally, this workshop was reframed to focus on a future vision and begin to articulate a technology road map for the exploitation of commercial game technologies.

3.0 WORKSHOP AGENDA

Monday April 16, 2012

1300	Administration	Meet at Villa Cambiaso and wait for stragglers. University administration
1320	Chairmen	Welcome and Introductions
1400	Chairmen	Serious Games in NATO and the Nations: Sharing and Moving Forward
1440	Prof Agostino Bruzzone	Welcome to Simulation Team
1520	Administration	Refreshment
1540	Paul Thurkettle	ITI Smart Defence
1620	Chairmen	Daily Recap
1630	Daily Adieu	

Tuesday April 17th, 2012

0900	Welcome	Recap from Day 1
0910	Dr. Johnny Garcia	Automated Intelligent Mentoring System
0950	Coffee	
1020	Chris Brannigan	SCORM the final frontier - delivering Immersive Training Simulations and rich performance data TODAY via your LMS
1100	Paolo Busetta	Improving Immersion by Making NPCs Believable
1140	Keerati Jittrawong	Gamified Information Systems: Toward an Efficient Delivery of Information
1220	Lunch	
1330	Mr. Calogero Brucato, Mr. Marco Biagini, Mr. Bruce Joy	Understanding Social Immersive Technology - Emerging frontiers for Training and Educational (T&E)
1410	Mattia Crespi	Web 3D - Virtual Worlds - Interactive Simulations - Serious Gaming - 3D Learning
1500	Coffee	
1515	Steve Ewert	How to Create A Dynamic & Destructible Simulation Environment
1550	Prof Agostino Bruzzone	Tour Simulation Team Facilities
All	"Daily Recap	Daily Adieu"

Wednesday April 18th, 2012

0900	Welcome	Recap from Day 2
0910	Phaedra Boinodiris	Evolving Serious Games beyond Training
1000	Coffee	
1030	Chris Haarmeijer	Empowering the end user
1100	Chris Haarmeijer	The Dutch Approach to Dismounted Soldier Training
1140	All	Adieu

4.0 PARTICIPANTS

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5.0 EXECUTIVE SUMMARY OF PRESENTATIONS:

Tuesday April 16, 2012

5.1 Opening remarks by Stu Armstrong and Wayne Buck

Mr. Buck and Mr. Stu Armstrong gave an introduction and background of the series of the serious games workshops. There were many new faces in the crowd and this background provided a good platform and baseline for all of the new attendees. Mr. Buck provided background on the following workshops:

- MSG-074 Exploiting Commercial Technologies and Games for Use in NATO
  - May 09. Farnborough, GBR. Current technologies including virtual worlds.
- MSG-078 Exploiting Commercial Technologies and Games for Use in NATO
  - Sep 09. Suffolk, USA. Games standards, security, and VV&A.
- MSG-093 Exploiting Commercial Technologies and Games for Use in NATO
  - Oct 10. Rome, ITA. MMOG, augmented reality, mixed reality, and standards.
- MSG-108 Exploiting Commercial Technologies and Games for Use in NATO
  - Oct 11. Farnborough, GBR. Games, mash-ups, social networking and interoperability.
- MSG-113 Exploiting Commercial Technologies and Games for Use in NATO
  - Apr 12. Genoa, ITA. Immersive technologies.
- MSG-xxx Exploiting Commercial Technologies and Games for Use in NATO
  - Nov 12. Oslo, NOR. Simulation and social media.

5.2 Wayne Buck and Stu Armstrong - Serious Games in NATO and the Nations: Sharing and Moving Forward exploiting M&S to enable NATO transformation.

Mr. Buck provided an update to the audience on ACT happenings and ACT's role as NATO's leading agent for change - driving, facilitating, and advocating continuous improvement of Alliance capabilities to maintain and enhance the military relevance and effectiveness of the Alliance as shown in figure 1 below.

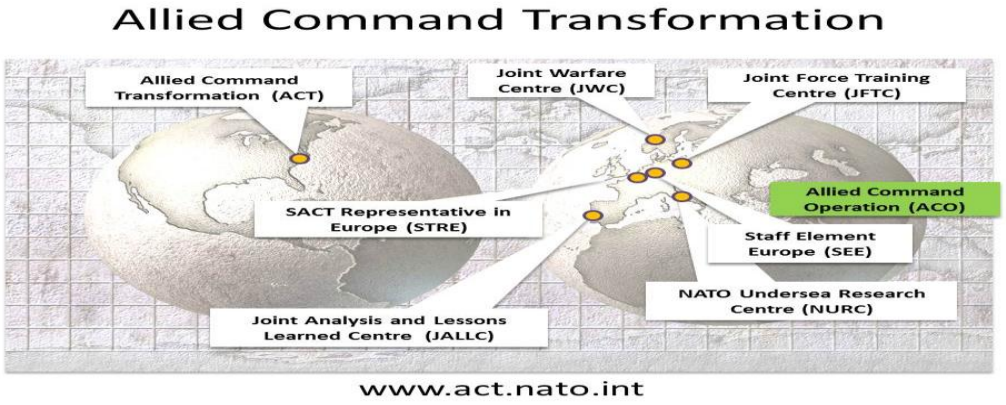


Figure 1: ACT as NATO's leading agent for change.

Mr. Buck further discussed areas that are benefiting from immersive technologies like:

- NATO Defence Planning Process
  - High level and typically dealing with difficult/expensive solutions
- Concept Development and Experimentation process
  - Mid-level and typically dealing with already existing solutions being applied to NATO
- Cross domain solutions investigated under an R&D or other umbrella
  - Serious games

Mr. Buck further discussed the need for M&S outreach and sharing with ACT and NATO partners as it relates to serious games supported event in 2012 and beyond:

- Simulation in Support of Current NATO-Led Operations
- Computer Assisted eXercises Architecture
- Human Factors in Military Training
- Interoperability Requirements for Immersive Environments
- Exploiting Commercial Technologies and Games for Use in NATO

Mr. Buck provided a summary of Commercial Technologies and games as shown in figure 2 below.

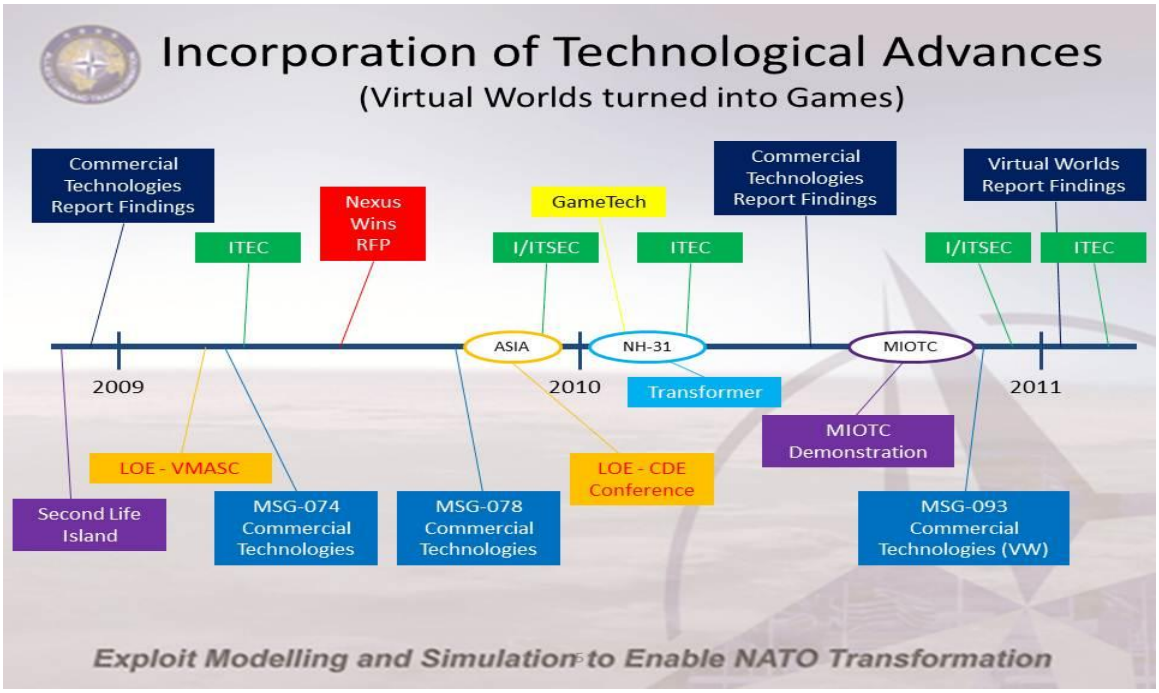


Figure 2 Virtual worlds turned into Games

Mr. Buck presented Virtual development of the HQ SACT is investigating technologies that may be used to augment or replace existing technologies for education and training as well as capability development. One of the investigative streams is in virtual worlds as shown in the examples below. To the right and below are the entrance and foyer area of NH-31. Below are screenshots of some of the existing conference rooms. These conference rooms have been constructed in detail so that when staff uses them virtually for meetings the surroundings will feel familiar.

Mr. Buck further discussed areas that are benefiting from serious games like:

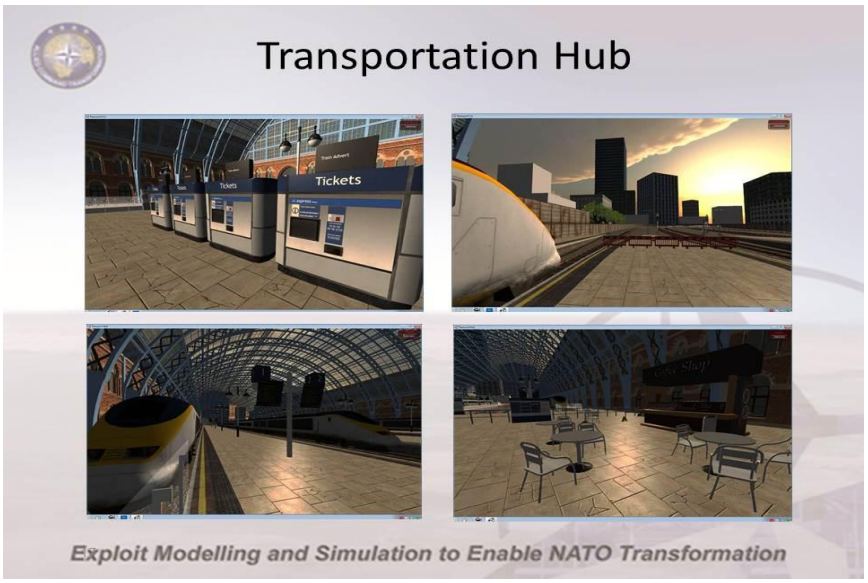
- Meeting & Collaboration
- Rapid Prototyping
- Training & Education
- Skill building
- Data Visualization & Analysis

Outreach

He further discussed Village Survey, Virtual Worlds and Borders Ahoy as well as D54 Incorporation of Technological Advances through Modeling and Simulation strategic Decision making Training through games. Mr. Buck further discussed the need to leverage MSG-113 as a forum to continue collaboration and he plans to conduct one more workshops in Oslo Norway in November 2012.
Mr. Stu Armstrong provided a presentation on Research Areas that QinetiQ and the United Kingdom is conducting as it relates to serious games he gave a quick review of the following:

Mr. Armstrong discussed that Synthetic training could save £100-600 million each year. He further discussed the need for MOD to have plug and play architecture as it relates to simulation and gaming.

He gave more ideas on other capabilities within gaming as it relates to game theory, cultural training and how to use training and transformation architectures. Mr. Armstrong further discussed the support of web enabled immersive environments like avatars levels of interoperability and training application for augmented reality – live fire against virtual targets. He also provided an example on the uses for transportation



5.3 Professor Agostino Bruzzone, University of Genoa, Simulation Team Welcome

Dr. Bruzzone discussed what the University of Genoa is doing as it relates to simulation and members of the group as shown in figure below.

Figure who we are

Dr. Bruzzone gave a history of the University of Genoa which is one of the oldest in Italy and in the World (founded in 1471 AD); it is located in middle of Italian Riviera. He gave a further description of DIPTEM which was founded in 1997 as evolution of the Institute of Technology and Industrial Management (ITIM) that was operative from 1960.

In 2011 DIPTEM evolved in DIME and it is currently composed by about 80 faculty members, 15 technicians and administrative, plus several PhD Students, external Researchers and Consultants. DIME teachers are involved in Undergraduate, Postgraduate and Professional activities in Engineering, Management. The Department staffs is in touch world-wide with the simulation community and is active in conferences, exhibitions and working meetings with the major Associations, Agencies and Companies as well as spin off and start-ups.

Dr. Bruzzone further described the role of The Liophant Simulation which involves over 120 Scientists and Technicians working in Companies and Academia. The Liophant develops Advanced R&D Projects for Real Applications.

He further discussed the role of Simulation of an Intelligence Board for Interactive Learning and Lofty Achievements (SIBILLA) which is a multiplayer web strategy game that simulate Terrorist Actions organized by different organization directed by IA that plan, prepare and execute attacks on specific:

1) Location
2) Site
3) Time
4) Threat Type

- The intelligence reports are distributed among the players based on their capabilities and shared by a stochastic engine.
- The identification of the attacks in time is the key for individual success; the players cooperate and compete for budget and success.
- Threat missed to be identified generate terrorist attacks that reduce global trust and support to intelligence agencies.

Dr. Bruzzone further described the Serious Games for Training in Strategic Decision Making (SGT-SDM) as a R&D Project to investigate the use of Serious Games for Training in Strategic Decision Making (SGT-SDM). The project involves an international team including ACT, NATO Defense College, M&S COE, Simulation Team, MISS DIPTEM University of Genoa and MAST.

He gave more examples of projects that the University of Genoa is leading. Here are more of those examples:

- Space Interoperable Refilling and Advanced Logistics Simulator (SPIRALS) - federate are in charge of the inventory management, the operations & logistics in the Moon Base.
- Interoperable Simulation of a Protection solution based on light Interceptor Tackler operating in Outer Space (IPHITOS) - This project is devoted to create a federate for Smack down, the initiative led by NASA & sponsored by several companies, devoted to diffusing and advancing the HLA culture by creating a distributed HLA Federation of a Moon Base.
- Cooperative/Competitive Utility for Management and Advanced Networking skill Acquisition - CUMANA is a Web Multiplayer Game that provides the opportunity to play interactively a cooperative/competitive game, in a distributed environment where different "Managers" operate concurrently with benefits and penalties connected to both common and individual objective achievements related to their role in their Corporation.
- Pandemic Dynamic Objects Reactive Agents (PANDORA) - PANDORA addresses the dynamics of the spreading of a Pandemic and experiments are on-going on H1N1 Influenza A virus by a joint simulation project involving USA, European and Australian R&D Centers (MISS DIPTEM, Dartmouth College, CRiCS).

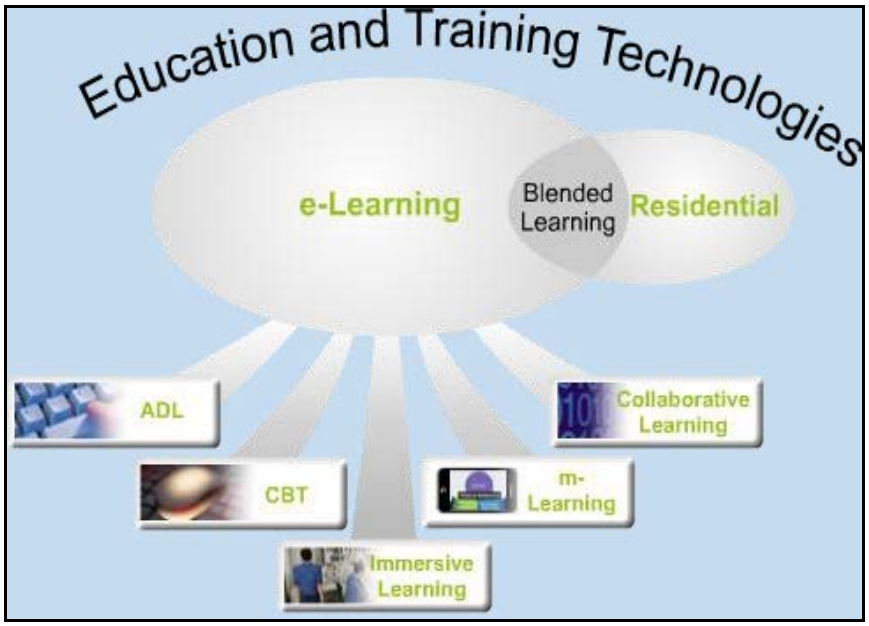
Dr. Bruzzone provided a numbers of working prototypes that shows the uses of serious games and modeling and simulation in support of operations that his simulation team is acting at the international level as a reference point between users and providers in simulation area. The integration of experts and technicians is providing very good results on real case studies and complex projects. An active area of development is related to distributed simulation and web-based modeling for extending the impact and exploitation of these proposed systems.

5.4 Paul Thurkettle Education & Training Technologies Section Joint Education Training & Exercises - NATO e-Learning Programme

Mr. Thurkettle provided a brief on the e-Learning Vision of ACT NATO Coherent approach

> *"e-Learning as an innovative and powerful method of teaching and learning that is directed, coordinated and promoted by ACT at the strategic level, whilst delegated to the most appropriate ETF to produce, develop, deliver and maintain effective, relevant and high quality courses"*

He mentioned that NATO e-learning can be delivered as standalone or residential based courses as shown on figure below.



Mr. Thurkettle showed some examples NATO e-learning through ADL, immersive learning, collaboration, CBT and mobile learning as being employed on NATO e-Learning Online System.

Mr. Thurkettle further described the use of Immersive Training Environments to encompass a "wrapper" over serious games, virtual worlds and other technology which provides a simulated or replicated environment for the trainer. He mentioned the extensive use of VBS 2 and its value to NATO with over 18 NATO nations using it. He gave examples of the uses of VBS 2 ongoing projects as they related to:

- Scripted Immersive learning capability by the Instructional Designer
- Import assets developed in other programs
- Easily developed into a game or task driven training
- Cultural training, CIS, security,
- Exported to LMS, IOS device, computer, Android system

Mr. Thurkettle described the approach of using Smart Defence as "a way to enhance the efficiency with which Allies, together, field critical capabilities, allowing them to do in cooperation what they could not do efficiently, if at all, alone.".

Mr. Thurkettle presented some challenges for the Immersive Learning Smart Defence:

- Discuss E&T applications for Immersive Learning
- Discuss how nations can work with NATO on distributed training
- Smart Defence/Work with GBR
- Valued-added metrics, proven advantages of ITE over standard e-learning or class based training
- Discuss Instructional Designer challenges and techniques for sound ISD development
- "Smart Defence" Industry reactions – "working together" - "is that possible?"
- Delivery methods – LMS, Mobile (what mobile?)
- Shared development – working together

In conclusion, Mr. Thurkettle mentioned we need to call serious games "immersive training", because senior leaders prefer it versus "gaming environments". He also mentioned in closing that the UK has committed to be the focal point to implement and develop a center to drive virtual worlds signed off by the Prime Minister.

Tuesday April 17th, 2012

5.5 Recap of Day 1

5.6 Johnny Garcia Automated Intelligent Mentoring System (AIMS).

Dr. Garcia gave a presentation on the uses of gaming platforms to conduct for teaching and assessing procedural clinical skills. Unlike current simulation training models, our technology provides audio-based procedural instruction and active visual cues coupled with structured and supported feedback on the results of each session. This system greatly enhances the ability to support direct, standardized "expert" mentorship for health professional as they learn and acquire new procedural clinical skills or are assessed in their proficiency in performing these skills.

Dr. Garcia further discussed the three-part aim for AIMS: satisfy the growing needs of defense medical community, provide a product to attain procedural mastery and effectively improve skills, and increase interest in simplified methods of training by providing a smart return on investment. AIMS is leveraging patent pending technology to create an automated intelligent mentoring system, primarily a software package that addresses procedural training needs within the health care community. The basic plan is to design a cloud-based training system – Software as a Service (SaaS)—that provides live feedback and detailed comparison of the user's results with curriculum mandated standards. With feedback and unlimited opportunity to attempt the procedure, the learner can achieve the expected proficiency at their own pace. AIMS is a cost-effective way to eliminate inconsistencies in training methods and to reduce mounting demands on expert clinical educators. This is achieved through low cost hardware and a software subscription package from our custom, web-based environment.

AIMS provides healthcare professionals, students, and practitioners a way to learn and perfect key skills they need to attain course objectives, recertification, or skills maintenance. This technology enhances deliberate and repetitive practice necessary to achieve skill mastery, accelerates skill acquisition since supervision and scheduling are minimized, and provides uniformity in training and competency assessments.

The figure below illustrates a template for user feedback. With feedback, the learner can repeat the task until achieving a measured level of proficiency. Without the need for supervision and allowing unlimited tries to reach proficiency means that learners can proceed at their own pace of learning and fitting their own scheduling needs. All this is accomplished with little or no teacher supervision, taught in a uniform manner, and according to the individualized needs of the learner.

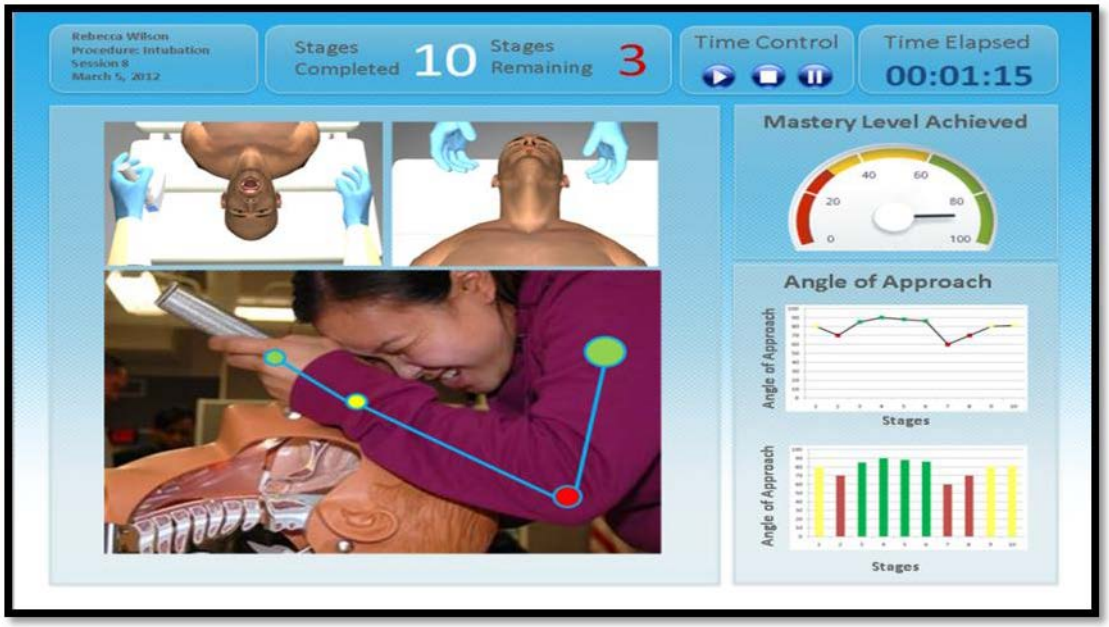


Figure Perfecting skills through perfect practice.

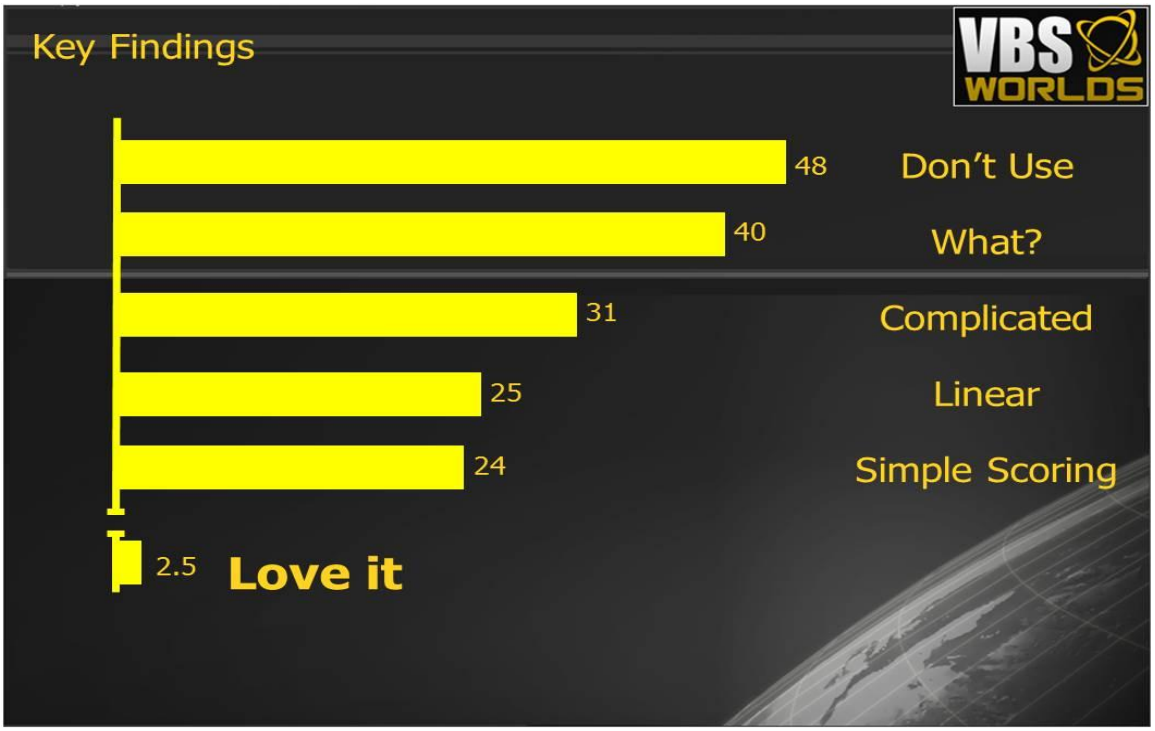
In conclusion, Dr. Garcia's presentations showed how gaming technology can be perfected for teaching and assessing endotracheal intubation and potentially expand it to include a variety of additional procedures

5.7 Chris Brannigan: SCORM the final frontier - delivering Immersive Training Simulations and rich performance data TODAY via your LMS

Mr. Brannigan gave a presentation on SCORM "Shareable Content Object Reference Model" (reference model for Shareable Content objects). He explained that SCORM is technically a "virtual" model (reference model), which is a collection of specifications that allows, primarily involving the exchange of digital content in platform-independent manner. He further explained what SCORM is good for - Online learning - SCORM is the de facto industry standard for interoperability, and it allows organizations to enhance their Learning Management System (LMS) – which is basically a content management system or a database for storing content and a means to present and interact with that content. SCORM is a set of protocols and API's that is wrapped around a course or lesson so that it can be managed and presented by the LMS.

He further discussed the need for SCORM in distributed simulation to get to hundreds of thousands of users. Mr. Brannigan described a survey of 51.5 randomly selected immersive training /simulation developers and users at I/ITSEC & Game-Tech conferences. The survey asked the question of what does SCORM mean to you?

Figure below show the results of the survey.



He discussed the findings as disturbing especially people who don't use SCORM, but then equally disturbing was the second response where they either did not know what it was or had a very poor understanding of it. This is reflected in the third highest response that was about complexity. There were issues about browsers, LMS and the files and protocols. It just seemed outside of their comfort zone. A number of respondents talked about linear content and not being suitable for simulation and the fact of simple scoring.

There is some good news. 2.5 respondents loved it. Admittedly, he thinks two of these worked for ADL in some shape of form and the .5 were under the influence. He further gave some examples of using SCORM within game engines that are played through a web browser that can leverage SCORM.

5.8 Paolo Busetta: Improving Immersion by Making NPCs Believable

Mr. Busetta gave a presentation on Realistic Human Behavior Models for use in operational assessment, training and experiments. These Virtual actors must:

- Respond dynamically to events
- Model cognition and emotion
- Have subtle perception and action

AOS Autonomous Decision making software was motivated to developing a SME-friendly representation, principled cognitive architecture and needed to be moderated by Physiology and Affect.

AOS has developed CoJACK to provide:

- Procedural knowledge
  - graphical plans
- Declarative knowledge
  - belief sets

- Goals and triggers
  - Events

CoJACK uses a graphical plan representation to encode the agent's reasoning capability (procedural knowledge). A graphical plan defines the context in which it is applicable and the various steps that must be followed for it to deal with the situation. In addition to its procedural knowledge ("knowing how to do something"), CoJACK agents have declarative knowledge ("knowing about"). In the figure, knowing that the squad leader has been killed is an example of declarative knowledge. Declarative knowledge is stored in belief sets within the agent. Mr. Busetta further described the constructs of CoJACK Plans – are procedures that define how to respond to events. When an event is generated, CoJACK computes the set of plans that are applicable to the event. These plans are subjected to a process of deliberation, where the agent selects the plan that will form its next intention. Plans have a body that defines the steps to be executed in response to the event. Non-deterministic choice allows the agent to try alternative plans to achieve the goal.

Events – are the central motivating factor in agents. Events are generated in response to external stimuli or as a result of internal agent computation.

Belief sets – are used to represent the agent's declarative beliefs in a first order, multiple-based relational form. Belief sets are analogous to the Working Memory (WM) of a production system.

Intentions – are the currently active plan instantiations, i.e., the plan instances that the agent is committed to. Plans are abstract entities that describe potential patterns of thought and action. A plan becomes an intention when the agent instantiates it with symbolic references to concrete entities in the environment and commits to its execution.

Based upon cognitive parameter values, the architectural constraints add latency to the current intention's reasoning steps and to memory access. CoJACK also affects the choice of beliefs retrieved in response to a memory access attempt; this includes effects such as: failure to retrieve a matching belief, retrieval of a belief that only partially matches, and retrieval of an alternative matching belief (i.e., not the one that CoJACK would have chosen first). A similar mechanism affects the selection of the next intention to execute. Thus the agent can choose an unanticipated intention or even fail to retrieve one of its current intentions. The cognitive parameters can be moderated at runtime, leading to further variation in behavior. For example, a caffeine moderator could be added that decreases the time taken to perform reasoning steps, leading to shorter response times.

He described the uses of fear and morale models - A currently used and appropriate way to model fear is to represent it as a reservoir. When fear is triggered in the behavior model, the amount of fear is used to initialize the level of the fear reservoir (instantaneously). The level of fear in the reservoir then decays over time with a half-life that is provided as an input to the moderator. This approach appears to be consistent with data on the effect of suppressive fire. This provides a robust implementation, and one that can be expanded and modified as additional data and needs arise. Variability between agents can be provided by varying the uptake and decay of fear constants as well as the base level. Variability with time is provided by the decay of fear. This approach is useful as a first step, as we want the models to be more complex but we also need them to not be too complex and difficult to understand, modify, and debug.

Mr. Busetta provided a demonstration/video of examples of UK research in cloud computing, crowd modeling and fear modeling

In conclusion, Mr. Busetta provided uses for other applications:

- Counterterrorism
  - Modeling of crowd and terrorist behavior

- Rules of Engagement (ROE)
  - ROE represented as meta-plans that constrain the selection of tactics
- Safety training
- High fidelity entities in crowd simulations (CAPIRE)

5.9 Keerati Jittrawong Gamified Information Systems: Toward an Efficient Delivery of Information

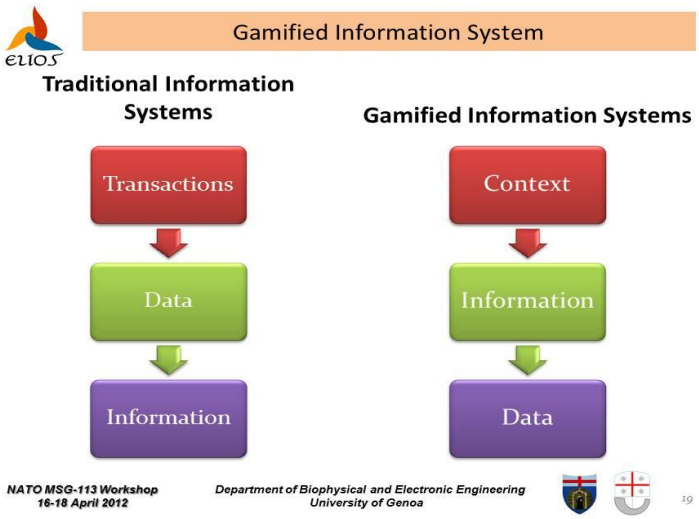
Mr. Keerati Jittrawong from the Department of Biophysical and Electronic Engineering University of Genoa gave a presentation of his thesis on Gamified Information Systems: Toward an Efficient Delivery of Information. His presentation was very enlightening as it brought the uses of games as an information platform allowing users that play games the ability to consume game information and making decision in a fraction of a second.

Mr. Jittrawong explained the importance of game information and interactive entertainment so that an audience can consume more information in less time.

He further discussed the need for underlying principles that enable efficiency (VIC):

- *Visual* - utilizes human preconscious information processing power
  - *Graphics uses for efficiency- a picture is worth a thousand words*
- Intuitive - eliminates abstract layers of information processing
  - Virtual worlds - intuitive information processing is unconscious You can do it without consciously thinking about it
- Contextual - makes it effortless to obtain appropriate information for the task at hand
  - Requirement for instantaneous and continuous decision making

He gave some examples of the used of the VIC principles in his Gamified Information Systems approach as shown in figure below.



He showed that using his research enables efficiencies than traditional information systems using context. He also provided a proof of concept where information is provided in a visual manner by replicating a container terminal into a 3D virtual world, and users can obtain information from the associated 3D objects. The most important information is displayed and enables the context for the training.

In summary, Mr. Jittrawong showed that the uses of his VIC principles enables efficiency, less error and it frees up conscious processing power.

5.10 Mr. Calogero Brucato, Mr. Marco Biagini, Mr. Bruce Joy Understanding Social Immersive Technology - Emerging frontiers for Training and Educational (T&E)

The gentlemen gave a presentation on immersive technologies and how it is used to provide T&E environments. They first defined an immersive experience as the use of multiple human senses to gain an experience not strictly related to a real environment. They further gave a great example of where you could have at your disposal the most immersive high-tech platform but if the content delivered is not involving the user, maybe the experience will not be so immersive.

They further discussed the Training and Educational environment as a frontier:

1) Last Frontier
    a) Current tools are faced with a few constraints
    b) Not yet fully cross platform
    c) Most require the client machine to install a software plugin or application
    d) Lacks immersion / Limited sense of participation
    e) Stovepipe environment (not interoperable with other apps including web-based media services
2) Next Frontier
    f) Web-based cross platform applications/mash-ups (users can dynamically choose from an extensible palette of media cloud services)
    g) More simultaneous participation supporting the e-learning “many to many” paradigm
    h) Automatic systems to provide evidences of personal skills and knowledge interacting with web services able to catch evidence of users T&E paths

They further discussed the need for crowdsourcing where better decisions are made by a few informed (from a filtered crowd) decision makers who than enable (the crowd) to decentralized actions where:

1) Independent vs. Biased sources
2) Diversity vs. Uniformity of advice
3) Decentralization vs. Centralization

They gave a demonstration of VastEvents which is the latest innovative 2.5D social network environment for crowdsourcing applications.

They gave a demonstrtion of VastCOMMAND – which implement a suite of tools built-in VastPark VP2 technology platform to enable basic and advanced features to operate a new concept of distributed command.

The main applications of VastCOMMAND are:

- Events Center
- Virtual Sand-Box

The Events Center is a 2.5D multimedia environment designed to enable remote collaboration and to support distributed decision making process using a web based suit of tools.

In conclusion the gentlemen showed the need for these environments for:

- High fidelity distributed T&E environment, High scalable across different web media services
- Reusability of immersive virtual simulators and immersive tools from training to support to operations
- Objective assessment of users through the adoption of SCORM 2, next generation LMS, that will be able to catch, evaluate and store transcripts of the learner's immersive experiences including decisions made during scenarios (i.e. via an XML cascade schema including ScenarioML, IMML, CBML and MSDL)

Immersive T&E experiences ***depends on contents*** and then on the technology delivered (2D, 2.5D, 3D, 4D).

"Right T&E content + Right T&E Technology = Maximum T&E performance"

5.11 Mattia Crespi: Web 3D - Virtual Worlds - Interactive Simulations - Serious Gaming - 3D Learning

Mr. Mattia Crespi provided the conference with a great presentation on the uses of virtual environments for risk training. His presentation gave examples of the new learning paradigms from books to tutorials and has the following benefits:

1) Safe environments
2) Creates unlimited hazards
3) Synchronous & collaborative training
4) Cheaper than real life
5) They can run on the web

He gave a context of the training as it would be executed in a construction yard for construction workers, architects, engineers and safety specialist to:

- Reduce training costs
- Raise courses participation
- Raise learning performance
- Enable new, more efficient learning methods

They used a mix of 2D learning tools with a 3D immersive environment to enhance the learning experience that was:

- Idiot proof
- Didn't force 3d some things are better done in 2d
- Monitor responses and analytics.
- Validate the simulation as a testing tool.

The solution of this approach was a virtual construction yard that finds risks, evaluate risks and enables operators to respond and act on danger. It furthermore provides a risk free environment to simulate hazards and monitor data effectively for measuring learners response. The part of the presentation that was a key factor to the success of this approach is how it was validated that he described in detail. They tested 800 learners, 400 in traditional approaches and 400 in virtual environment, where:

- User tested on specific complex procedures with tests, after 30 days from the official test.
- 3D simulation learners scored on average 32% more than standard learners.

In conclusion, this presentation showed that the use of virtual construction yards saves time and money and is a good example for risk reduction enhancements.

5.12 How to Create a Dynamic & Destructible Simulation Environment

Specific military approach Game technology needs support.

Steve started his presentation by mentioning that Havok is a wholly owned subsidiary of Intel ® Corporation and that it recently acquired Trinigy, a leading 3D game engine provider. The integration of Havok technologies with the Vision Engine is providing a powerful and customizable platform that enables teams of all sizes to deliver compelling content and experiences across multiple devices and operating systems. Steve discussed a Havok's robust global customer support infrastructure and its business model that includes professional services and/or licensing through standard annual support & updates, and single or program-based deployment.

Steve referenced breakthrough AI in such games as LA Noire and how its behavior tool facilitates a custom character behavior tool in which discrete events can be prototyped, controlled and scripted.

He then demonstrated several live demos of Havok products including: Havok - Physics, Destruction, AI, Animation, Behavior and Cloth. Ewart concluded by mentioning how it is working with partners such as Presagis, Terrasim, Calytrix, Rocketbox and others to implement DIS/HLA interoperability and terrain generation.

See: www.havok.com and www.trinigy.net

5.13 Tour Simulation Team Facilities University Genoa

Dr. Bruzzone provided a great presentation on the uses of serious games for homeland security. He gave the workshop a brief description of who the research team is from a range of Universities, Research Centers and Companies operating worldwide in synergy for developing Innovative Solutions with a particular focus in Modeling and Simulation.

Dr. Bruzzone further gave demonstration of gaming tools coupled with human behavior in serious games:

- Serious Games usually have a stronghold in graphics, usability, interfaces and multiplayer capabilities.
- Games frameworks needs to guarantee proper fidelity and correct models for their specific purpose
- The potential application areas usually introduce the necessity to add Artificial Intelligence (AI) able to add realism by introducing Human Behaviors and Intelligent Agents (IA)

He further discussed human modeling challenges as they relate to rational decision making and instinctive and emotional behaviors. He also defined human behavior simulation is the reproduction of the humans by using computer models. Usually this requires simulating aspects related to Emotions, Rational Thinking, Psychology, Ethology and Sociology with the detail required by the specific Modeling & Simulation Project.

Dr. Bruzzone provided more information and demonstrations on the use of Multiplayer Games introduce new opportunities for Serious Applications integrated with Intelligent Agents:

- Human Behavior Models enhance this potential providing new opportunities
- There is a great potential in using Serious Game as technology enabler to enlarge installations, user community and utilization modes
- It critical to define reference baseline for fidelity and detail level that characterize Serious Games considering the expected benefits and use modes.

Wednesday April 18th, 2012

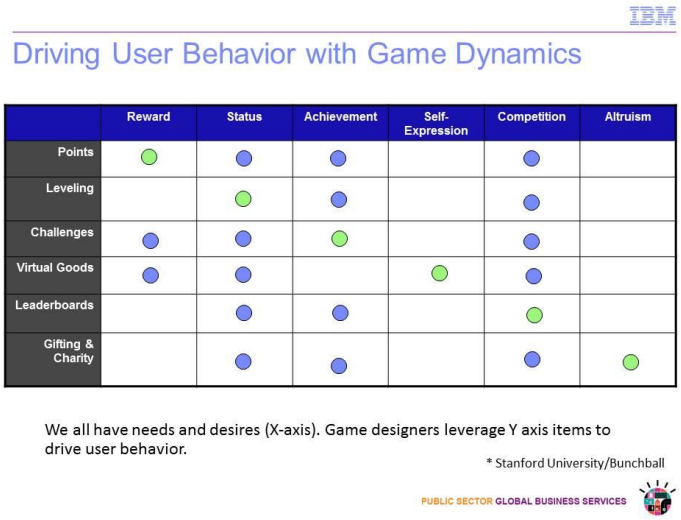
Recap of Day 2

5.14 Phaedra Boinodiris: IBM Evolving Serious Games beyond Training

Mrs. Phaedra Boinodiris gave a wonderful presentation on the evolution of games in commercial and government evolution, from the evolution of process optimization to complex problem solving. She gave a brief history on where she came from as the founder of women gamers to the development of gaming environments for IBM. Mrs. Boinodiris provided that the average age of the gamer today is 37. 43% of PC gamers and 38% of console gamers are women. 67% of US heads of households play videogames regularly. These are our logisticians, our analysts, our partners. These gamers are not playing simple games; they are playing extremely complex games. Games today are more sophisticated than ever- supporting thousands of players at a time playing simultaneously against sophisticated AI engines. Collaborative play, user driven content, and in-game currency are now the norm.

She provided us examples of sophisticated games like Achron shown below where the use of real time strategy game is utilized using a 4 dimensional strategy.

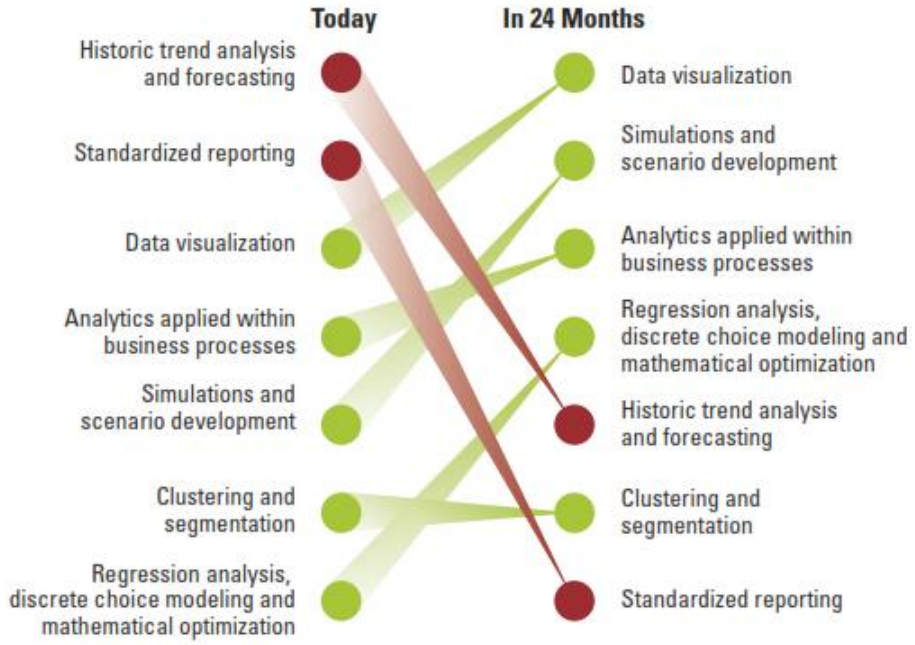
She mentioned that today we know that serious games are being used by the military, by healthcare, and now by businesses to teach and even to solve major problems. What is driving user behaviors with game dynamics figure below?



It shows that the user's needs and desires (X-axis). Game designers leverage Y axis to drive user behavior.

She provided some key factors and studies that are using data visualization; simulations and scenario development will be the most valuable techniques to analyze all the data.

The figure below provides what the new paths are headed.



> *"Organizations expect that the ability to visualize data differently will be the most valuable technique in two years [Fall of 2012]. Other technique and activities that are current delivering value today will still be done, but will be of less value."*

With the confluence of technology there is an opportunity to extend what games can do and IBM is positioned to leverage processes in smarter serious games where Games in the context of data exploration, and Serious Games in the context of process optimization for ROI.

She mentioned Ender's Game a book by Orson Scott Card is about a young boy who becomes the world's greatest military leader by playing games. But the cool part about the book is that unbeknownst to him, he is directly affecting the battlefield by his gameplay. She expressed, "This is the Art of the Possible. This is where serious games are going."

She gave an example where a process model can be transformed for an organization that is responsible for logistics across multiple agencies into something that is contextual and motivates people to iteratively play; the by-product of the gameplay is a newly optimized model. This will lead to a broader value chain that will be **motivated** to **collaborate** and optimize the visually represented system with flows of REAL DATA.

Based on information, by 2015:

> "More than **50 Percent** of organizations that manage innovation processes will GAMIFY those processes." -- Gartner

She gave more examples of using the transformation of data into visual representations that enables better decision support tools.

1) Using Serious Games for Optimal Modelling *FOLD-IT* for Folding Proteins
2) Find where the music sounds off key in order to teach a compiler how to better annotate security problems in code
3) ACTUV Simulator
4) Watson - an adaptive analytics application

She provided a great keynote to the conference, and she concluded with some actionable task for the audience:

Where to start – Fun vs. Flow – "beware of the chocolate covered broccoli"

1) ROI
2) Learning/Pain Points
3) Puzzles/Experience to Teach & Motivate
4) Genre
5) Platform

She mentioned to the audience that we are all gamers and that Games can be extremely adept at explaining complex systems. When designed well, they can be used to collaboratively solve very complex problems, whether the players actively realize it or not.

Recap from Wayne Buck, Stu Armstrong and Professor Agostino

Discussed the Oslo, Norway event for fall 2012 and opened up the floor to the audience.

Ten Ideas for structure of future workshop

1) Generate more ideas and issues/uses to work on like structure design and metrics for planning – have more time for syndicate groups.
2) What about mobile?
3) Validation of the gaming applications
4) Helps to close the gap between understanding the problem to solve the problem this workshop puts the context of operations in use of gaming as it relates to academia.

5) More technical discussions in future workshops
6) Continue to push the idea of serious games as a capability
7) Would like to know who is the main provider of serious games
8) Aid the Military in how to manage this technology to create an educational path in order to use serious games
9) How to use serious games in Concept development and experimentation.
10) Recommended other speakers to the workshop.

6.0 CONCLUSION AND RECOMMENDATIONS

During the course of the workshop, several themes or "hard questions" were identified including:

- Business Models – What are the business models that governments will use to procure commercial games and technologies? What is the appropriate business model for industry?
- Workshop intent and purpose – What will the NATO nations do to exploit new technologies and commercial games that they learn about at the workshop?
- Large vs. small business – What are the roles for the larger prime companies and the roles of the smaller games vendors? How do they best work together?
- Changing environment – The focus on the use or potential use of new technologies is changing, but how are the governments and industry going to adapt?
- Workshop plug-up – There is a desire for the government to see working demonstrations and a desire for industry to meet a plug-up challenge.

6.1 Conclusion

Participants and workshop organizers assessed this session of MSG-113 as a success. The workshop met its objectives:

- provide demonstrations and presentations to explore uses of commercial games and technologies in support of decision support, training, educational concept development and experimentation
- provide updates on the nations' current application of commercial technologies
- provide capability briefings

NATO partner nations currently use commercial games and technologies. The workshop participants concluded that a need and to continue pursuing commercial game technology solutions. This may require review of existing acquisition and procurement guidelines.

Finally, NATO and ACT enjoy an organizational infrastructure and innovative partners to facilitate these types of workshops in the future. They should continue to do so.

6.2 Recommendations

As noted in the closing discussion, gaming technology has been proven to enhance operations. The workshop focused on providing examples of these transformational changes in NATO nations and organization and shows that serious games are the future, and the workshop has provided value and should and will continue to do so.

MSG-114 - Exploiting Commercial Games and Technology for Military Use
12th Workshop
(STO-MP-MSG-114)

Executive Summary

The exploitation of commercial technologies and appropriate use of open standards can provide efficiencies and increased benefits for M&S Defence applications. There is a need to identify those technologies having the greatest near-term potential, and understand the future trends and developments in those technologies that have potential, to meet future Defence requirements. Also, the emergence of social networking technologies and the evolution of digital games have helped shape the way in which people are communicating, collaborating, operating, and forming social constructs. All this can be clearly seen in new generations of students. Young people have been completely normalized by digital technologies—it is a fully integrated aspect of their lives

Simulations, digital gaming, and social networking technologies have all definitely suffered the same public relations problems that all new technologies experience. However, there are countless examples of these technologies demonstrating their educational value to other industries, confirming the powerful learning opportunities and advantages they afford. These technologies are safe, valuable tools that our learning institutions must take seriously.

Aim of the Workshop

As with previous workshops, this workshop was planned to share national experiences, explore commercial and games technologies, understand best practices, and to identify barriers to further exploitation and ways these might be overcome.

Workshop Objectives

In particular, this workshop dealt with digital gaming, and social networking technologies and the realities of their usage, as well as the challenges of interoperability.

1. Conduct of the Workshop: MSG-114 convened 13-15 November 2012 in Kjeller (just outside of Oslo), Norway. The workshop was attended by30 invited ACT, NATO national representatives, and industry representatives participating in 13 presentations and concluding in discussions of high interest topics.
2. Conclusion: Participants and workshop organizers assessed this session of MSG-114 as a complete success. The workshop met its objectives:
    - Provide presentations to explore supportive of exploitation of commercial games and technologies as it relates to operations, training, experimentation and concept development;
    - Provide updates on the nations' current application of commercial games and immersive and virtual capabilities; and

- Provide capability briefings and technical interchange with NATO organizations and NATO partners on success and issues with the implementation of virtual and immersive commercial games within their organizations.

MSG 114 showed that NATO nations use virtual and immersive technologies for training and experimentation. The workshop participants concluded that a need to continue pursuing these technologies is a must, but more actions need to be taken in the measures and metrics of technologies, education of user's, and the evaluation of existing acquisition and procurement guidelines. Finally, NATO and ACT enjoy an organizational infrastructure and innovative partnership to facilitate these types of workshops in the future. I recommend they continue with these educational forums.

Commercial Technologies and Games for Use in NATO – 12th Workshop

Technical Evaluator's Report

Johnny Garcia Ph.D.
SimIS Inc.

Summary of Proceedings

1.0 PURPOSE:

The purpose of this Summary of Proceedings is to document the NATO Modelling & Simulation Group (NMSG) MSG-114 Workshop on Exploiting Commercial Games and Technology for Use in NATO. Through discussion and debate, attendees acquired knowledge and experience in the possible topic areas. Technical and application briefings and demonstrations on selected commercial technology areas helped the attendees better understand the issues, so that they may more properly aid in the development of the strategy for the NATO and the Nations to exploit these technologies. The workshop convened 13-15 November2012 in Kjeller, Norway.

2.0 OBJECTIVE OF THE WORKSHOP:

- the background and affordances of simulations, digital games, and social networking;
- the cognitive implications of these technologies;
- specific challenges with using these tools for education and training, as well as strategies for overcoming these challenges in order to achieve successful learning experiences;
- the practical impact of these technologies in preparing warfighters;
- the practical impact of these technologies in educating support trades such as supply, transportation, and police; and
- the future of these technologies and their impact on learning and teaching.

As with past workshops, this workshop facilitated the sharing of national experiences, exploration of commercial game technologies, understanding of best practices, and identification of barriers and solutions to further exploitation. Additionally, this workshop was reframed to focus on a future vision and began to articulate a technology road map for the exploitation of commercial game technologies.

3.0 WORKSHOP AGENDA

Tuesday November 13, 2012

1300	Administration	Meet at Kunnskapsbyen Conference Centre
1320	Chairmen	Welcome to FFI and Introductions
1345	Chairmen	Games and Transmedia in NATO and the Nations. Sharing and Moving Forward

1415	Dr. Elaine Raybourn	Transmedia
1500	Administration	Refreshment
1530	Kory Kumm	Havoc
1600	Chairmen	Daily Recap
1630	Daily Adieu	
	Wednesday November 14th, 2012	
0900	Welcome	Recap from Day 1
0910	Hilde Hafnor	Joint 2013" - Searching for New Military Learning Practices
0950	Coffee	
1020	Bruce Joy	An online community model for NATO trainers
1100	Mattia Crespi	Gamification in learning paradigms
1140	Dr. Johnny Garcia	Update to Automated Intelligent Mentoring System
1220	Lunch	
1330	Peter Morrison	Update on Bohemia
1410	Jan Eric Blix	VBS2 at the Norwegian Army Land Warfare Centre
1500	Coffee	
1530	Dr. Bard Reitan	Mobile devices as an element in games and simulation
1600	Dr. Lars Lovlie	Distributed simulations of realistic unmanned systems at FFI
1630	All	"Daily Recap Daily Adieu"
	Thursday November 15th, 2012	
0900	Welcome	Recap from Day 2
0910	CDR Sondergaard	NATO Education and e-learning
1000	Coffee	
1030	Stu Armstrong	Is Social gaming a Fad
1100	Chairmen and Host	Wrap-Up
1140	All	Adieu

4.0 PARTICIPANTS

NATO UNCLASSIFIED MSG-114 Commercial Technologies and Games for Use in NATO - 12th WS (Norway)			
Name	**Nation**	**Role**	**Attended**
AALERUD Jens Ragnar (Manager)	Norway	Guest	☐
ALMQVIST Østen (Site Mgr)	Norway	Guest	☐
ARMSTRONG Stuart (Mr)	United Kingdom	Chair	☐
BENTSEN Dan Helge (Mr)	Norway	Member	☐
BERGH Arild (Dr)	Norway	Guest	☐
BIGG Colin (Mr)	United Kingdom	Guest	☐
BRATHEN Karsten (Mr)	Norway	Panel Member	☐
BUCK Wayne (Mr)	Canada	Chair	☐
ELSTAD Ann-Kristin (Ms)	Norway	Guest	☐
EVENSEN Per-Idar (Mr)	Norway	Guest	☐
FRANK Anders (Mr)	Sweden	Guest	☐
GARCIA Johnny (Dr)	United States	Chair	☐
GÅSVIK Morten (1. Lt)	Norway	Lecturer	☐
HAFNOR Hilde (Ms)	Norway	Technical Team Member	☐
HALSOR Marius H (Mr)	Norway	Observer	☐
HOLEN Jan Erik (Mr)	Norway	Lecturer	☐
KRARUP-HANSEN Niels (Mr)	Denmark	Panel Member	☐
LEWIS Mark (Mr)	United Kingdom	Observer	☐
MARTINET Jerome (Mr.)	France	Guest	☐
MELAND Hans-Marius (Hr)	Norway	Observer	☐
MORRISON Peter (Mr)	Australia	Lecturer	☐
NYGÅRD Helena (Ms)	Norway	Guest	☐
POPA Stefan (Captain)	Romania	Observer	☐
RADMACHER Richard (Mr)	Germany	Observer	☐
SONDERGAARD Svein-Inge (CDR)	Norway	Guest	☐
SUKAND MEELIS (Capt)	Estonia	Member	☐
TAFF Chris (CS04)	Canada	Member	☐
VOICULET Adrian (Mr)	Romania	Support Staff	☐

5.0 EXECUTIVE SUMMARY OF PRESENTATIONS:

Tuesday November 13th, 2012

5.1 Opening discussions and welcome by Hilde and introduction of the Norwegian Defence Research (FFI)

Ms. Hafnor discussed that FFI is the only major Defence R&D center for Norway that was established in 1946 and has 693 staff members.

Opening remarks by Stu Armstrong and Wayne Buck – Transmedia – what is it?

Mr. Buck and Mr. Armstrong gave an introduction and background of the serious games workshops. There were many new faces in the crowd and this background provided a good platform and baseline for all of the new attendees. Mr. Armstrong discussed the changes of technologies since 2007. Armstrong provided a video that shows social media and discussed whether social gaming is a fad from Socialnomics. Facebook, Twitter and YouTube are banned from MOD and DOD networks.

5.2 Wayne Buck and Stu Armstrong – Exploiting modeling and simulation to enable NATO transformation

Mr. Buck provided an update to the audience on ACT happenings and ACT's role as NATO's leading agent for change - driving, facilitating, and advocating continuous improvement of Alliance capabilities to maintain and enhance the military relevance and effectiveness of the Alliance as shown in Figure 1 below.

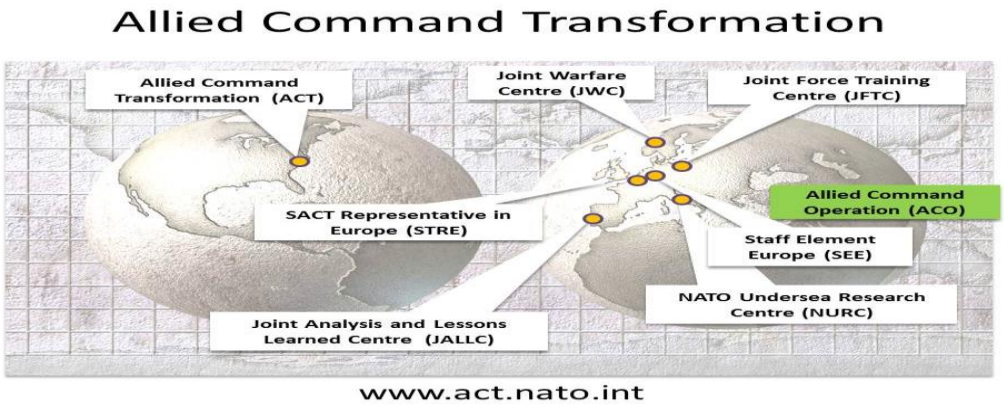


Figure 1: ACT as NATO's leading agent for change.

Mr. Buck further discussed NATO Requirements:

- NATO Defence Planning Process
  - High level and typically dealing with difficult/expensive solutions
- Concept Development and Experimentation process
  - Mid-level and typically dealing with already existing solutions being applied to NATO
- Cross domain solutions investigated under an R&D or other umbrella
  - Serious games

Mr. Buck further discussed the need for M&S outreach and sharing with ACT and NATO partners as it relates to serious games supported events in 2012 and beyond:

- Simulation in Support of Current NATO-Led Operations
- Computer Assisted Exercises Architecture
- Human Factors in Military Training
- Interoperability Requirements for Immersive Environments
- Exploiting Commercial Technologies and Games for Use in NATO

Mr. Buck provided a summary of the ACT investigation campaign in virtual worlds as shown in Figure 2 below.

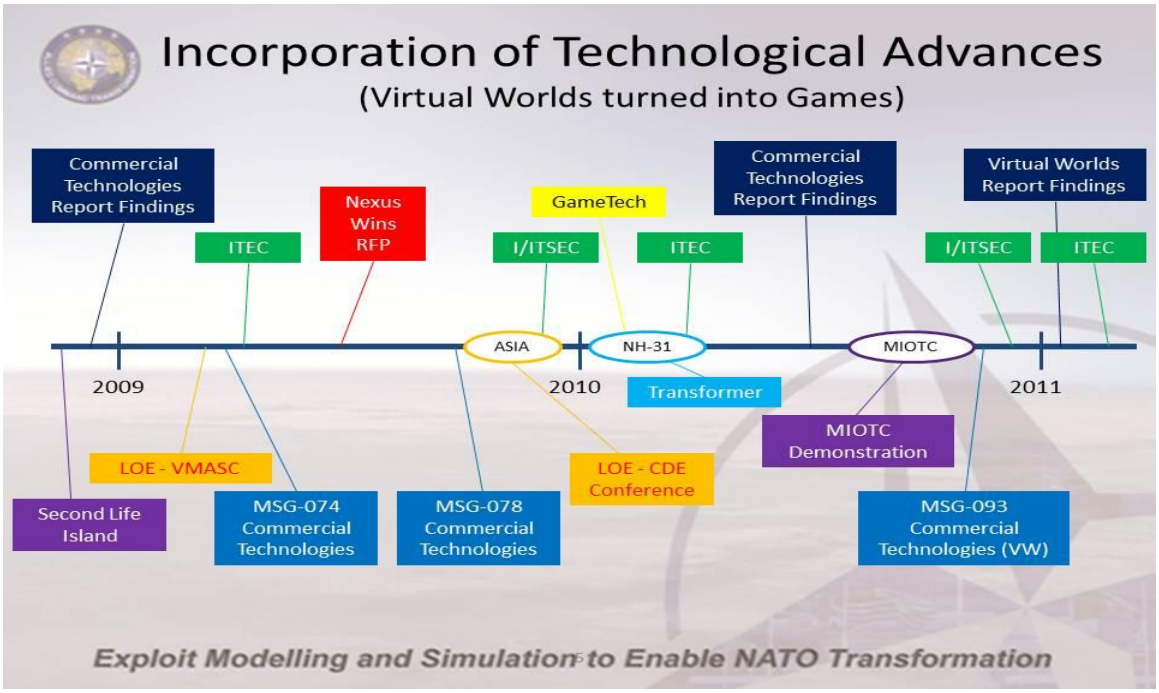


Figure 2: Virtual Worlds turned into Games

Mr. Buck presented virtual development of the HQ SACT and is investigating technologies that may be used to augment or replace existing technologies for education and training as well as capability development. One of the investigative streams is in virtual worlds as shown in the examples below. To the right and below are the entrance and foyer area of NH-31. Following are screenshots of some of the existing conference rooms. These conference rooms have been constructed in detail so that when staff uses them virtually for meetings, the surroundings will feel familiar.






Figure 3: Conference Rooms

Mr. Buck further discussed areas that are benefiting from serious games like:

- Meeting & Collaboration
- Rapid Prototyping
- Training & Education
- Skill building
- Data Visualization & Analysis
- Outreach

Mr. Buck provided background on the following workshops:

- MSG-074 Exploiting Commercial Technologies and Games for Use in NATO
  - May 09. Farnborough, GBR. Current technologies including virtual worlds.
- MSG-078 Exploiting Commercial Technologies and Games for Use in NATO
  - Sep 09. Suffolk, USA. Games standards, security, and VV&A.
- MSG-093 Exploiting Commercial Technologies and Games for Use in NATO
  - Oct 10. Rome, ITA. MMOG, augmented reality, mixed reality, and standards.
- MSG-108 Exploiting Commercial Technologies and Games for Use in NATO
  - Oct 11. Farnborough, GBR. Games, mash-ups, social networking and interoperability.
- MSG-113 Exploiting Commercial Technologies and Games for Use in NATO
  - Apr 12. Genoa, ITA. Immersive technologies.
- MSG-114 Exploiting Commercial Technologies and Games for Use in NATO
  - Nov 12. Oslo, NOR. Simulation and social media.

He further discussed Village Survey, Virtual Worlds and Borders Ahoy as well as D54 Incorporation of Technological Advances through Modeling and Simulation with strategic decision making and training through games.

- Gaming technology / serious games
- Operational and strategic / political level
- NATO Defence College and ARRC
- Several Planned studies, workshops and demonstrations

Mr. Stu Armstrong provided a presentation on Research Areas that the United Kingdom is conducting as it relates to serious games, and gave a quick review of the following to increase technical maturity:

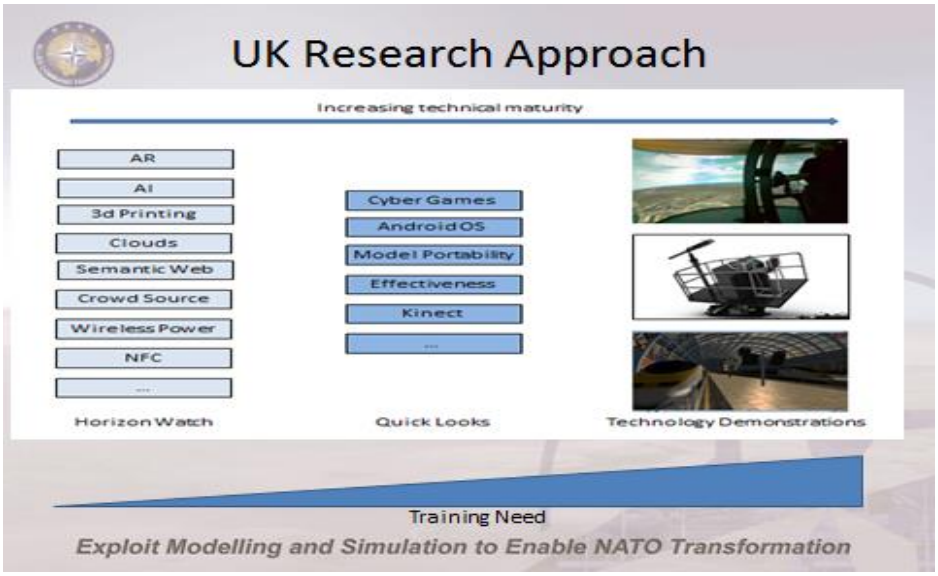


Figure 4: UK Research Approach –Increasing Technical Maturity

Here are some UK game technology examples:

Figure 5: UK Game Technology Examples

Figure 6: Gunnery Training Solutions

He gave more ideas on other capabilities within gaming as it relates to game theory, cultural training, and how to use training and transformation architectures. Mr. Armstrong further discussed the support of web enabled immersive environments like avatars levels of interoperability and training application for augmented reality – live fire against virtual targets. He also mentioned the need to purchase and leverage COTS products. He provided more examples of some simulation projects that focused on integration and interoperation. He further expressed the cost of these projects in the past and what the UK recently spent for these projects.

Figure 7: Niteworks Aviation Sim Project (AH64D)

Mr. Armstrong further gave a presentation on other uses of these types of applications outside of the military domain. He also discussed how they are using different games for use in these domains. It's all about cost and time on how gameplay can be used and understanding the limits of game play and the impacts as it relates to narratives of the game. He mentioned he is working on a paper for these findings.

Figure 8: Transportation Hub

5.3 Transmedia for effective training and Education: Elaine Raybourn PHD Research Scientist and National Laboratory Advisor ADL

Dr. Raybourn provided a brief introduction of Transmedia and Transmedia for military training as part of her research.

> "A transmedia story unfolds across multiple media platforms with each new text making a distinctive and valuable contribution to the whole"

-Henry Jenkins, Convergence Culture

Quote from Mark Long, *GameTech 2011 Keynote,*

> "We are in a transitional period where our relationship with media is shifting to multiple screens. Our audience is growing up in a digital world. The playing, reading patterns, and habits of young and old are changing as reading extends from the printed page to tablets and to a future of a myriad of diverse devices."

Why does the military need a transmedia framework?

Figure 9: Why we need a Transmedia Framework

She showed how to incorporate mobile devices in training. Without a framework nothing is cohesive and reinforcement is needed.

Dr. Raybourn is a big advocate of live action training – which has an emphasis of crucible training – that can be shifted when needed to. This enables learning. She showed a picture of the limbic system to illustrate how different portions of the brain work and how this is related to training.

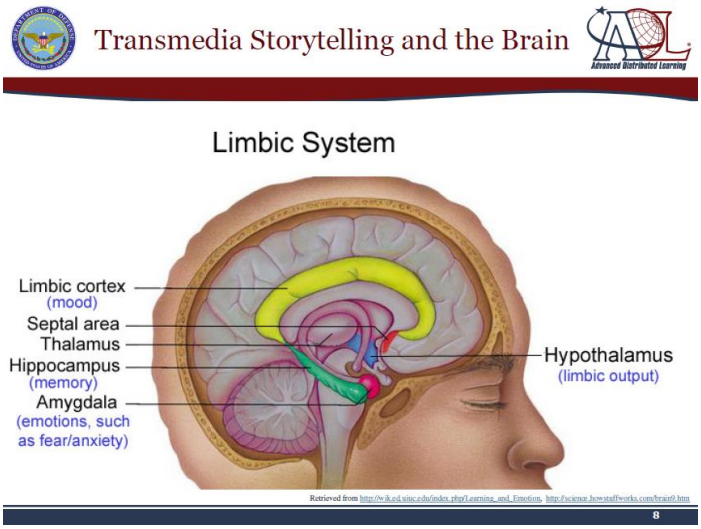


Figure 10: The Limbic System of the brain

It showed characteristics of social process simulations. (Gredler, 1992)

Simulation experimentation design framework showed how to incorporate reinforcement for the training requirement. This allows for the creation of a Transmedia campaign where the trainee is the protagonist.

Figure 11: Simulation Experience Design Framework

She further described each quadrant of the graphic and gave an example of America's Army Game to help communicate what soldiering encompasses the use of social media as an advantage to the military

She also defined a transmedia universe as a means to create a campaign using social media and other content to draw the audience to imagine their backstories, side stories, and future stories shaped in large part by audience participation.

She provided a video of machinima – uses at TBOC showed the video of an IED explosion and how it affects the squad. One would notice them taking the aggression out on locals and how it affects their lives. She explained how the training can be affected and gave examples of a graphic novel and how it's being done for Training support packages as graphic novels using VBS 2.

She provided a recipe from Mark Long on transmedia and what is needed in figure 12 below.

Figure 12: Mark Long's List

She concluded with the possibilities of transmedia and how it can reinforce an idea even more.

5.4 Dynamic and Immersive 3D Training Technologies. Cory Kim HAVOC

Mr. Kumm gave a quick rundown of HAVOC - Cory started his presentation by mentioning that Havok is a wholly owned subsidiary of Intel ® Corporation and that it recently acquired Trinigy, a leading 3D game engine provider. The integration of Havok technologies with the Vision Engine is providing a powerful and customizable platform that enables teams of all sizes to deliver compelling content and experiences across multiple devices and operating systems. Steve discussed Havok's robust global customer support infrastructure and its business model that includes professional services and/or licensing through standard annual support & updates, and single or program-based deployment.

Cory referenced breakthrough AI in such games as LA Noire and how its behavior tool facilitates a custom character behavior tool in which discrete events can be prototyped, controlled and scripted. He further discussed HAVOK products and HAVOK partners. He described Havok vision engine features, Havok animations, HAVOK AI and Atmospheric blending, and Havok physics.

He then produced several live demos of Havok products including: Havok - Physics, Destruction, AI, Animation, Behavior and Cloth. He concluded by mentioning how it is working with partners such as Presagis, Terrasim, Calytrix, and Rocketbox amongst others to implement DIS/HLA interoperability and terrain generation.

See: www.havok.com and www.trinigy.net

5.5 Joint 2013" - Searching for New Military Learning Practices. Hilde Hafnor

Ms. Hilde Hafnor –

Joint 2013's Aim: To develop the cadets' ability to think and reflect on the meanings and implications of modern military collaboration, communication and leadership by putting their experience and knowledge in a larger context.

This is done through:

- Exploring the effects of modern gaming and lightweight simulation technologies in combination with other social technologies;
- Addressing emerging types of military training/learning and experimentation areas that are usually not covered by highly advanced "traditional" M&S technology; and
- Training/Learning people-to-people (peer-to-peer) interactions with other humans to solve real problems in a highly complex and rapidly evolving environment

Practicing and learning face-to-face is not an option in the near future for Norway, yet semi exposure is possible.

Joint 2013 is:

- Learning about others- role playing the joint scenario; and
- Giving cadet's resources to understand how to address the modern conflict through shared cognitive frame of understanding – cross collaboration and cross-communication in a collective (together) state.

They discussed the research and educational approach as seen in Figures 13 and 14 below.

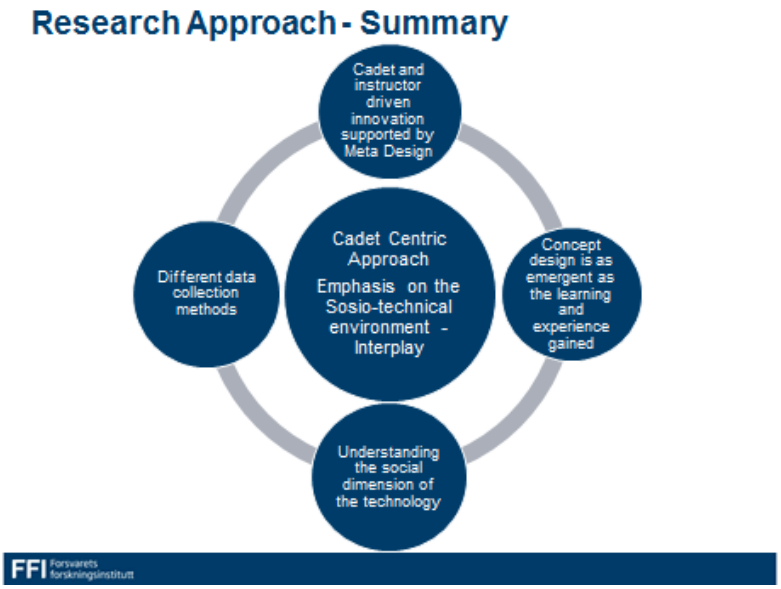


Figure 13: Research Approach – Summary

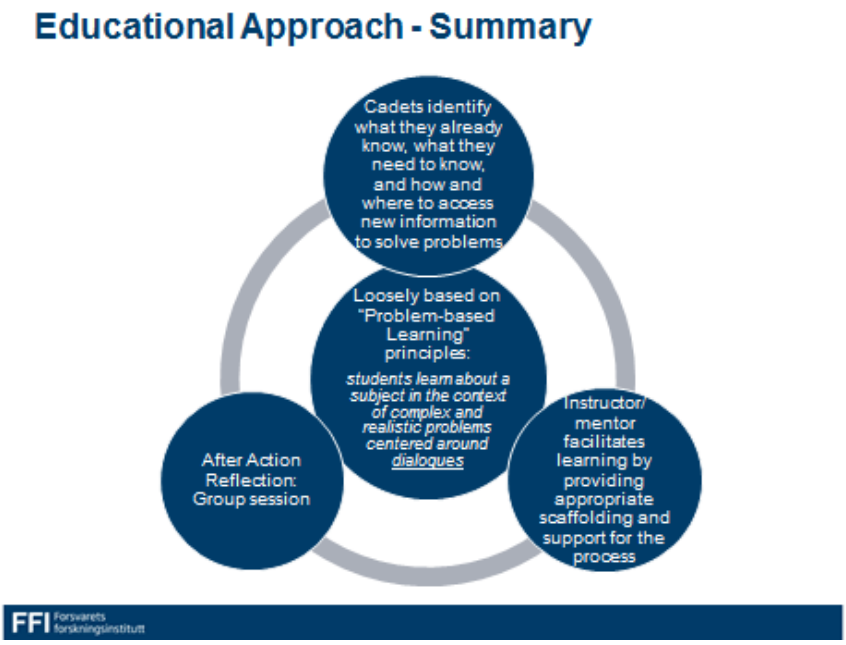


Figure 14: Educational Approach – Summary

The concept of "Walk a mile in someone else's shoes" to experience and learn a situation from "the others" perspective was discussed with explanations of the virtual set-up.

There is also interest in web-based simulation (wargaming)

The cadets who went through the exercise felt they had learned something in a positive and new way. The advantages to this type of learning experience:

- Relatively simple
- Low cost
- No prior training needed

5.6 Mr. Bruce Joy and Marco Biagini - An Online Community of model for NATO Trainers (remotely done through Skype)

Mr. Joy gave a presentation on immersive technologies and how it is used to provide T&E environments for use in commercial and military applications. Integrating collaborative learning and immersive learning within a private online community of practice that focusses on critical thinking, effective collaboration as seen in Figure 15: NATO's e-Learning initiative as part of the NATO E-Learning requirements in accelerating culture change in NATO.

Figure 15: NATO's e-Learning initiative

He further discussed the concept and the online community of practice (COP) and the challenges and benefits of using COP by an example called SERMO; an online community exclusively for physicians and NURsim and train the trainer community prototype.

He discussed the approach of planning via immersive learning and uses of immersive media markup language (IMML) and the technical barriers of it.

1) managing and maintaining security
2) Lowering the barrier for wider participation

He discussed the uses of NATO future mission training network and the NATO network enabled capability (NNEC).

He summarized the used of domain specific communities of practice that show promise. And concluded with a quote from Aristotle: "Excellence is never an accident. It is always the result of high intention, sincere effort, and intelligent execution: It represents the wise choice of many alternatives".

5.7 Mattia Crespi Gamification in learning paradigms – How Gamification is evolving our learning models. (remotely done through Skype)

Mattia provided some questions he will try to answer

A new generation of users:

- grown up immersed in technology and the Internet
- different focus and different learning style
- learning style greatly influenced by videogames
- master massive collaborative games

His presentation proved that Engagement makes a difference. If learning is fun, they remember better and want to learn more. He also provided emotional incentives.

Emotion is the biggest driver – small steps towards motivation

Matrix of how motivation can be achieved is in Figure 16.

ACHIEVEMENT	SOCIAL	IMMERSION
• Advancement • Progress, power, accumulation, status	• Socializing • Casual chat, helping others, making friends	• Discovery • Exploration, lore, finding hidden things
• Mechanics • Numbers, optimization, templating, analysis	• Relationship • Personal, self-disclosure, find and give support	• Role-playing • Story line, character history, roles, fantasy
• Competition • Challenging others, provocation, domination	• Teamwork • Collaboration, groups, group achievements	• Customization • Appearences, accessories, style, color schemes
		• Escapism • Relax, escape from real life, avoid real life problems

Figure 16: Motivation can be achieved through…..

He stated that motivation can be achieved by a mix of these elements but it has to be kept simple and tied to rewards. He provided an example of how Gamification changed participation within a media See Figure 17: How Gamification changed our participation with media.

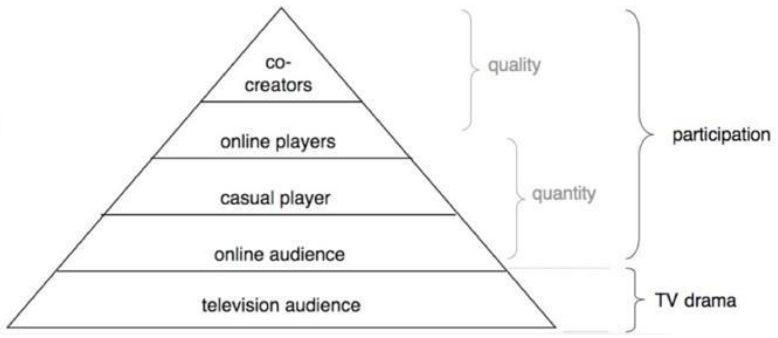


Figure 17: How Gamification changed our participation with media…..

Using leveling in games is vital to develop engagement.

A modern learning tool should be

1) Motivating
2) Simple

Serious games as knowledge incubators.

Collaborative serious games allow players to work together and allows for

1) Simple
2) Sociable
3) Symbiotic

He further discussed the future of learning.

He described a new sustainable model for learning.

He concluded:

- Participation has become a vital commodity that many organizations have not yet figured out how to capture.
- Many Learning projects fail to achieve the desired results, often because they are designed to capture attention rather than create engagement.
- Forward-looking organizations can seek out advantages by taking several key steps toward capturing engagement of learners.

Mr. Mattia Crespi provided the conference with a great presentation on the uses of virtual environments for risk training. His presentation gave examples of the new learning paradigms from books to tutorials and has the following benefits:

1) Safe environments
2) Creates unlimited hazards
3) Synchronous & collaborative training
4) Cheaper than real life
5) They can run on the web

He gave a context of the training as it would be executed in a construction yard for construction workers, architects, engineers and safety specialist to:

- Reduce training costs
- Raise courses participation
- Raise learning performance
- Enable new, more efficient learning methods

They used a mix of 2D learning tools with a 3D immersive environment to enhance the learning experience that was:

- Idiot proof
- Didn't force 3D; some things are better done in 2D
- Monitor responses and analytics
- Validate the simulation as a testing tool

The solution of this approach was a virtual construction yard that finds risks, evaluates risks and enables operators to respond and act on danger. It furthermore provides a risk free environment to simulate hazards and monitor data effectively for measuring learners' response. The part of the presentation that was a key factor to the success of this approach is how it was validated that he described in detail. They tested 800 learners; 400 in traditional approaches, and 400 in virtual environments, where:

- User tested on specific complex procedures with tests, after 30 days from the official test.
- 3D simulation learners scored on average 32% more than standard learners.

In conclusion, this presentation showed that the use of virtual construction yards saves time and money and is a good example for risk reduction enhancements.

5.8 Johnny Garcia An update on the Automated Intelligent Mentoring System (AIMS).

Dr. Garcia gave a presentation on the uses of gaming platforms to conduct for teaching and assessing procedural clinical skills. Unlike current simulation training models, our technology provides audio-based procedural instruction and active visual cues coupled with structured and supported feedback on the results of each session. This system greatly enhances the ability to support direct, standardized "expert" mentorship for health professionals as they learn and acquire new procedural clinical skills or are assessed in their proficiency in performing these skills.

Dr. Garcia further discussed the three-part aim for AIMS: satisfy the growing needs of Defence medical community, provide a product to attain procedural mastery and effectively improve skills, and increase interest in simplified methods of training by providing a smart return on investment. AIMS is leveraging patent pending technology to create an automated intelligent mentoring system, primarily a software package that addresses procedural training needs within the health care community. The basic plan is to design a cloud-based training system – Software as a Service (SaaS)—that provides live feedback and detailed comparison of the user's results with curriculum mandated standards. With feedback and unlimited opportunity to attempt the procedure, the learner can achieve the expected proficiency at their own pace. AIMS is a cost-effective way to eliminate inconsistencies in training methods and to reduce mounting demands on expert clinical educators. This is achieved through low cost hardware and a software subscription package from a custom, web-based environment.

AIMS provide healthcare professionals, students, and practitioners a way to learn and perfect key skills they need to attain course objectives, recertification, or skills maintenance. This technology enhances deliberate and repetitive practice necessary to achieve skill mastery, accelerates skill acquisition since supervision and scheduling are minimized, and provides uniformity in training and competency assessments.

Figure 18 below illustrates a template for user feedback. With feedback, the learner can repeat the task until achieving a measured level of proficiency. Without the need for supervision and allowing unlimited tries to reach proficiency, means that learners can proceed at their own pace of learning and fitting their own scheduling needs. All this is accomplished with little or no teacher supervision, taught in a uniform manner, and according to the individualized needs of the learner.

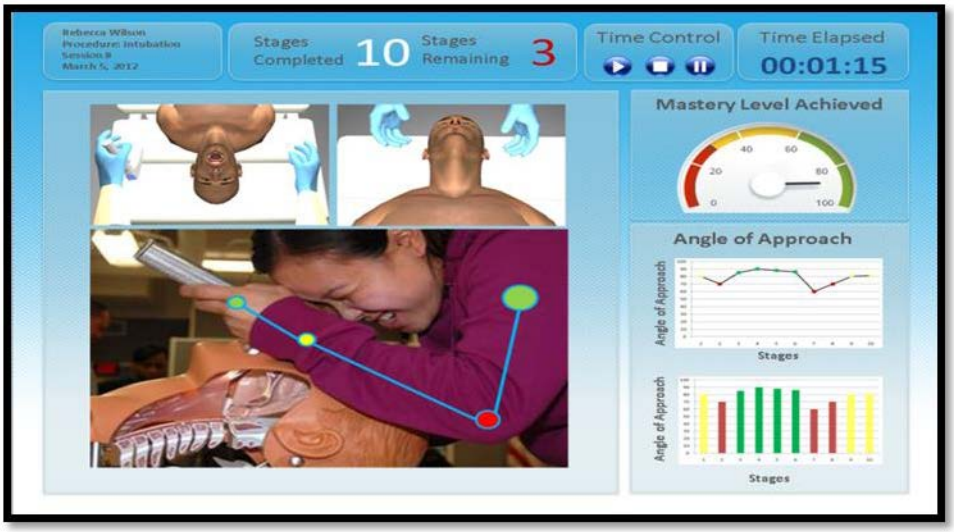


Figure 18: Perfecting skills through perfect practice.

In conclusion, Dr. Garcia's presentations showed how gaming technology can be perfected for teaching and assessing endotracheal intubation and potentially expand it to include a variety of additional procedures.

5.9 Mobile Devices as an element in games and simulations – Bard Reitan FFI

Dr. Reitan gave a presentation on mobile devices activities and described the mobile complex graphic. He mentioned the focus of FFI from advanced distributed learning to services and information available in military operations as a broad scope for research.

He provided us examples of the types of research he is conducting as it relates to availability of the devices to complement existing capabilities as shown below.

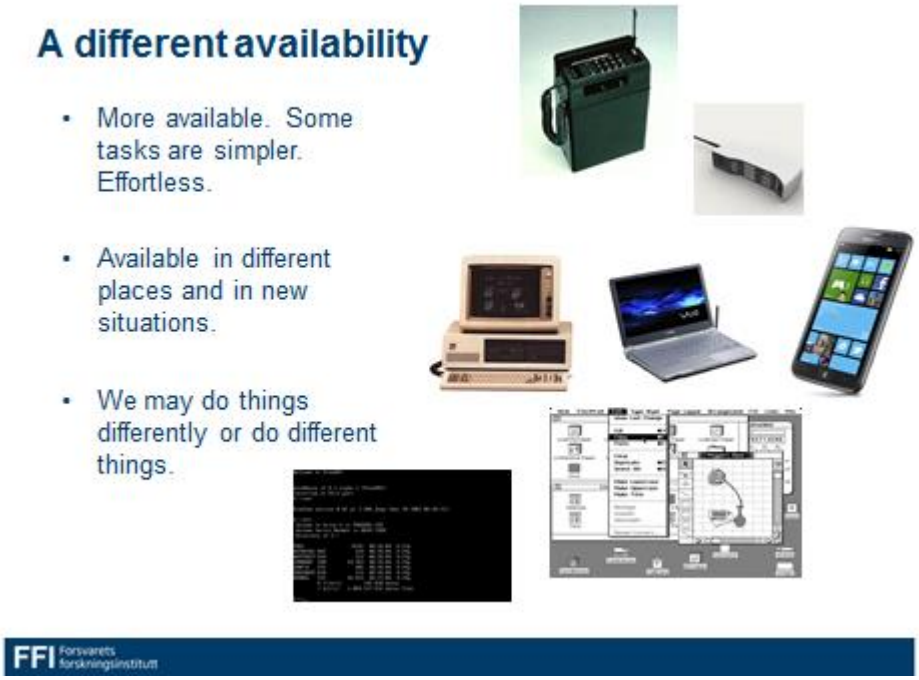


Figure 19: A different availability

Dr. Reitan further provided the focus areas of FFI:

- Increase the availability and quality of information/educational material/reference material or even digital/virtual arenas. E.g. for just in time learning or to include feedbacks in knowledge creation.
- Simple app generation, distribution and maintenance of apps.
- Military operations use-cases (communication, collaboration, sharing of information)

He showed us an article from 1991 that showed the use of hardware and software in 21st century and it hit hard that we are using these devices today. See figure 20.

The Computer for the 21st Century

Specialized elements of hardware and software, connected by wires, radio waves and infrared, will be so ubiquitous that no one will notice their presence

by Mark Weiser

The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it.

Consider writing, perhaps the first information technology. The ability to represent spoken language symbolically for long-term storage freed information from the limits of individual memory. Today this technology is ubiquitous in industrialized countries. Not only do books, magazines and newspapers convey written information, but so do street signs, billboards, shop signs and even graffiti. Candy wrappers are covered in writing. The constant background presence of these products of "literacy technology" does not require active attention, but the information to be transmitted is ready for use at a glance. It is difficult to imagine modern life otherwise.

Silicon-based information technology, in contrast, is far from having become part of the environment. More than 50 million personal computers have been sold, and the computer nonetheless remains largely in a world of its own. It is approachable only through complex jargon that has nothing to do with the tasks for which people use computers. The state of the art is perhaps analogous to the period when scribes had to know as much about making ink or baking clay as they did about writing.

The arcane aura that surrounds personal computers is not just a "user interface" problem. My colleagues and I at the Xerox Palo Alto Research Center think that the idea of a "personal" computer itself is misplaced and that the vision of laptop machines, notebooks and "knowledge navigators" is only a transitional step toward achieving the real potential of information technology. Such machines cannot truly make computing an integral, invisible part of people's lives. We are therefore trying to conceive a new way of thinking about computers, one that takes into account the human world and allows the computers themselves to vanish into the background.

Such a disappearance is a fundamental consequence not of technology but of human psychology. Whenever people learn something sufficiently well, they cease to be aware of it. When you look at a street sign, for example, you absorb its information without consciously performing the act of reading. Computer scientist, economist and Nobelist Herbert A. Simon calls this phenomenon "compiling"; philosopher Michael Polanyi calls it the "tacit dimension"; psychologist J. J. Gibson calls it "visual invariants"; philosophers Hans Georg Gadamer and Martin Heidegger call it the "horizon" and the "ready-to-hand"; John Seely Brown of PARC calls it the "periphery." All say, in essence, that only when things disappear in this way are we freed to use them without thinking and so to focus beyond them on new goals.

The idea of integrating computers seamlessly into the world at large runs counter to a number of present-day trends. "Ubiquitous computing" in this context does not mean just computers that can be carried to the beach, jungle or airport. Even the most powerful notebook computer, with access to a worldwide information network, still focuses attention on a single box. By analogy with writing, carrying a super laptop is like owning just one very important book. Customizing this book, even writing millions of other books, does not begin to capture the real power of literacy.

Furthermore, although ubiquitous computers may use sound and video in addition to text and graphics, that does not make them "multimedia computers." Today's multimedia machine makes the computer screen into a demanding focus of attention rather than allowing it to fade into the background.

Perhaps most diametrically opposed to our vision is the notion of virtual reality, which attempts to make a world inside the computer. Users don special goggles that project an artificial scene onto their eyes; they wear gloves or even bodysuits that sense their motions and gestures so that they can move about and manipulate virtual objects. Although it may have its purpose in allowing people to explore realms otherwise inaccessible—the insides of cells, the surfaces of distant planets, the information web of data bases—virtual reality is only a map, not a territory. It excludes desks, offices, other people not wearing goggles and bodysuits, weather, trees, walks, chance encounters and, in general, the infinite richness of the universe. Virtual reality focuses an enormous apparatus on simulating the world rather than on invisibly enhancing the world that already exists.

Indeed, the opposition between the

MARK WEISER is head of the Computer Science Laboratory at the Xerox Palo Alto Research Center. He is working on the next revolution of computing after workstations, variously known as ubiquitous computing or embodied virtuality. Before working at PARC, he was a professor of computer science at the University of Maryland; he received his Ph.D. from the University of Michigan in 1979. Weiser also helped found an electronic publishing company and a video arts company and claims to enjoy computer programming "for the fun of it." His most recent technical work involved the implementation of new theories of automatic computer memory reclamation, known in the field as garbage collection.

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FFI Forsvarets forskningsinstitutt

Figure 20: The Computer for the 21st Century

He further mentioned the need for games and simulations to be in the background so that

- Services are delivered using a network and few requirements on the client.
- Mobile devices when:
  - you would like to carry the simulation/game with you,
  - a mobile device takes less effort,
  - you want to do a long-running game/simulation (in-between other tasks),
  - you would like fewer or no constraints on where the participants are located.

In summary he provided the complexity of mobile environment shown below as:

- Vast resources put into the mobile complex, something to take advantage of.
- The mobile complex may be utilized to make games/simulations more available:
  - Carry along the game/simulation or information produced therein.
  - Second terminal.
  - Long-running games/simulations. Participate in-between other tasks.
  - Fewer or no constraints on participants location

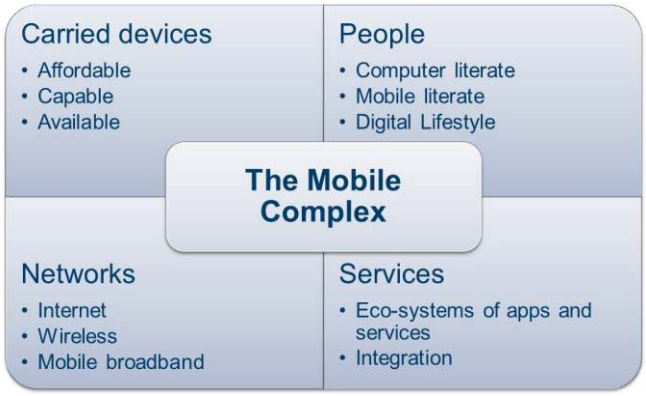

Figure 21: the Mobile Complex

5.10 Games, virtual worlds and free to play and industry perspective – Pete Morrison Bohemia interactive.

Pete discussed the difference in games for entertainment and games for training as a basis to understand the users and the requirements of the environments. He provided an introduction of games, virtual worlds and the "free to play" concept. He provided a number of examples with a focus on what it all means for the military. Pete mentioned that for a game to be entertaining it requires immersive gameplay, but for a game to be effective in training, it needs to facilitate learning. The relationship between gameplay and learning is complex and is a big area of research. In Defence, we see a lack of education about the potential of games. He wants his focus, as CEO of Bohemia, on the fallacy that immersion requires high fidelity, for example photo-realistic graphics.

Pete gave many examples as part of his presentation:

- Virtual world – persistence or the illusion of persistence – gave an example of second life example (global love day)
- Gave an example of DAY Z – DayZ is a modification of our Arma II computer game, the game engine upon which VBS2 v2.0 was based. It is known as a "hardcore zombie survival sim". Players start with only a can of beans in a post-apocalyptic virtual environment, and the goal is simply to survive. Players must scavenge for supplies, hunt and cook animals and establish camps. Threats include hordes of zombies and most importantly the other players. DayZ went viral earlier this year and this has kept the underlying game, Arma II, very popular. It's a zombie survival game. He showed a video of zombie survival game. Avoid the zombies…
    - Each DayZ server supports either 60 or 100 players, and they all play on terrain that looks like this, 15km x 15km.
    - The only difference between DayZ and traditional virtual worlds is that login steps hidden from the player. The server is allocated automatically, and typically the player will be taken from the start screen directly into the game shown in figure below. But here's the trick: even in massively multiplayer games, there are very rarely actually *masses* of players interacting directly. Like the illusion of persistence, game developers are giving you an illusion of massively multiplayer, and there are many techniques used to trick the user into thinking they are playing alongside thousands of other people.

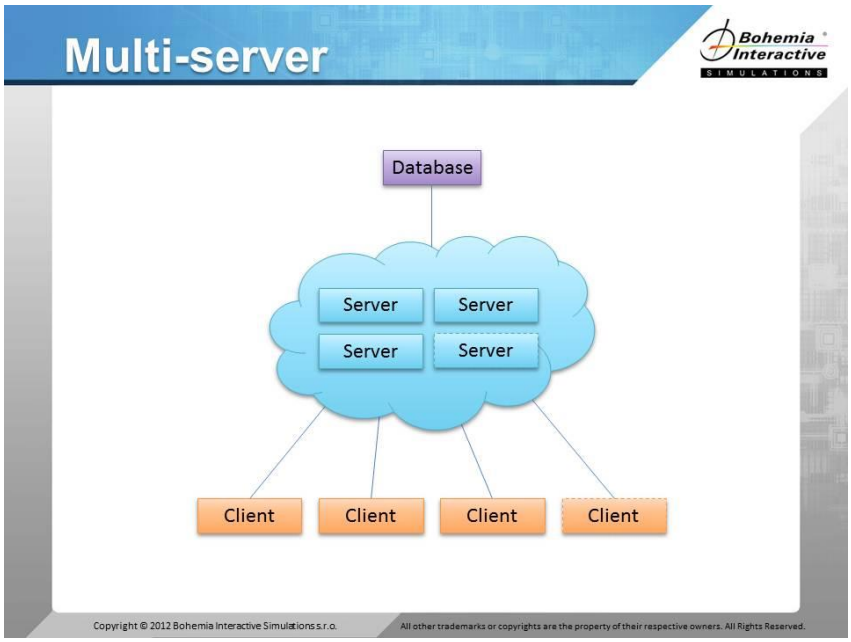

Figure 22: Multi-Server map

- Eve Online is a space combat game in which participants operate a ship (one ship per participant).
  - Eve Online maxes out at around 1500 on the one shard, and even this requires a range of interesting techniques including time dilation to support that many players. Time dilation simply slows everything down when the system is under load, to give the server more time to communicate with all the players and properly resolve the conflict. It works well in Eve because it is not twitch-based, but in first-person games like DayZ this technique will be less effective (it would be like playing in slow motion).
- The next example is Guild Wars 2. This is a very new MMO title released in August of this year. It is more traditional in its approach. Like World of Warcraft or Second Life, it splits it's territories up and distributes them amongst servers. Players will operate within these territories, a few hundred players at once on a single server. But – because you can skip to these different territories at will (and jump servers); it gives you this feeling that you are participating with thousands of other players, not just a few hundred. If a single territory gets overloaded, then the system just creates a new copy and puts the additional players on that. This is tried and tested load balancing for an MMO.
- Lastly, he talked about World of Tanks. He discussed it in greater detail later, but noted that this is an MMO that supports concurrency of tens of thousands of players, on server clusters in the US, Europe and Asia. The point to note at this stage is that this MMO only supports 15 x 15 players on 1km terrains!

Clearly, "massively multiplayer" simply refers to the number of players that connect to the server clusters, not the maximum number of players that can interact at once.

Pete used these examples to get a point across that Multi-server has been possible within the military using either HLA or DIS for many years, and filtering provides a crude form of load balancing. In his opinion, any game or simulation that supports multi-server, multi-player capability should be considered (and meets the definition of) a virtual world as shown in figure 23 below.

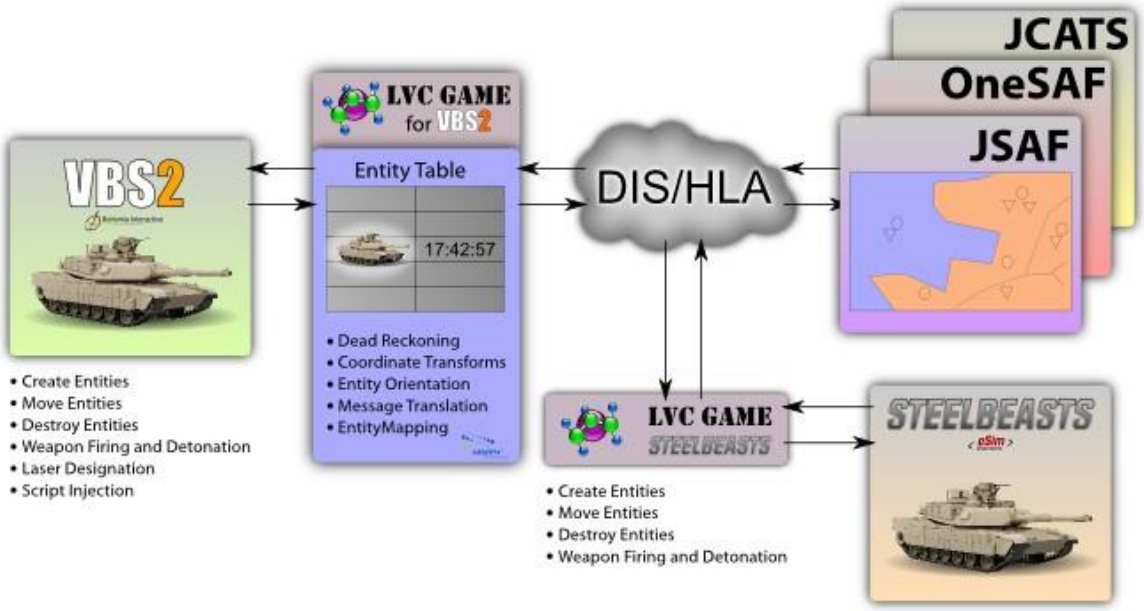

Figure 23: Considered Virtual World

He showed that virtual worlds are games that have a) the illusion of persistence, and b) the illusion of supporting thousands of players. Up until 2011, these distinctions were significant and games were categorized as being either massively multiplayer, or not. What we are seeing now, however, is an important change and it is due to the "free to play" concept.

"Free to play" has many variations, but at its heart it means "optional subscription fee". For many years, the big MMO games (such as Eve Online and World of Warcraft) all had monthly subscriptions and this further separated them from the traditional gaming business model (buying a box in a store). Over the past year or two, however, new games have begun to do away with subscription fees in order to compete and this trend is very important. Newer online games rely on the following primary sources of income:

1) Initial purchase fee, and/or
2) In-game (possibly micro) transactions

It should also be noted that the "always online" nature of these games help the developers control piracy.

One of the first and most successful free to play games is World of Tanks, which has no initial purchase fee and relies entirely on in-game transactions. World of Tanks involves 15 on 15 players, driving tanks, tank destroyers or artillery and trying to blow each other up. Interestingly it is still considered "massively multiplayer" but at any one time only 30 players are ever in the one game! World of Tanks is a classic rags-to-riches story for the developer, who was initially shunned by publishers around the globe and told that the business model wouldn't work. The developer, Wargaming.net, published the game itself and now makes a profit of tens of millions of dollars and (reportedly) has a concurrent user count similar to Second Life.

Guild Wars 2 is more akin to a virtual world than a single player game, but it is widely hailed as a possible successor to World of Warcraft, largely because it took everything that players disliked about WoW and built a whole new game that addresses all of these issues. Whereas WoW requires multiplayer cooperation, Guild Wars 2 simply encourages it, with a focus on fun rather than grinding up levels. The whole game is designed to be finished by a single player, which is unique for an MMO (usually they seek to encourage group play so there will be more subscribers). Guild Wars 2 has about a $70 initial cost but is free to play from there. The result is an intriguing experience.

His final example was Diablo 3. The Diablo series is a very popular series of top-down single player games, in which players battle though countless dungeons leveling up characters and fighting ever more difficult enemies. Diablo I and II were single player experiences only, but Diablo III is a single player experience with a significant online component. This online component does allow friends to play together, but also it allows players to trade (which is important for immersion), and also purchase new items with real money. The important point is that Diablo III, like any other MMO, is "always online", even though it really is focused on the single player experience.

Now what is interesting about Diablo is that it has a "Real Money Auction House", that allows players to trade in-game items for… real money.

Key Points he had provided so far

- "Persistence" is an illusion
  - Essentially saving and reloading player state
- "Massively" multiplayer != thousands playing together
  - Refers to the number that can connect to the server cluster, not the number that can interact at once within the game world
- Games with online components are becoming common
  - "Online virtual community" = "Virtual World"
  - Being online helps defeat piracy and allows in-game transactions
- All of the examples given are built on bespoke engines
  - There is no "best" game engine for a Virtual World!
- Players are happy to download huge data files (> 10GB)
  - Stand-alone executable are the accepted norm
  - The most popular virtual worlds are *not* browser-based

He concluded that:

- The distinction between games and virtual worlds is… [arguably] obsolete
- Both persistence and massively multiplayer are tricks to deliver a specific gameplay experience
  - Not difficult to implement, most game engines already support both
- We should consider GameTech streams based upon user requirement (tactical training, integration with simulators etc), instead of focusing on the technical
- Educate the customer!

  If you want to leverage game technology, don't ignore the trends in the game industry!

5.11 Exploring Commercial Games for use at NATO Use of VBS2 in Norwegian army – Gasvik Army

Brief topics were the use of VBS2 in the Norwegian Army

Explained how it was used during exercise and who are the users, the biggest user is the artillery and the warfare center, with the terrain being generated for the users. He also showed examples for fire area for utility of DTED and SHAPE files into the environment giving an example of the company commander course in the spring.

- Discussed the breakdown of the setup and the resources used for the environment.
- Gave discussion on experiences on the uses of tools.
- Dan provided more details of the KONGSBERG training system.
- Gave an architecture description of the training environment.
- Jan gave further data of the training capabilities and described how it's done in the Live and Virtual environments for this gave a demonstration of the game and where it was. He also gave more examples of the exercise control.
- Uses of the UAV
- Distributed Simulation of realistic unmanned systems at FFI – Dr. Lars Sundness
- Motivation – discussed the testing of the UAV
- Goal for the simulator
- Example applications –
  - Environmental
  - Topographical
  - Technical
  - Organizational

5.12 Recap of the day-Wayne Buck

Mr. Buck finished the day with a brief discussion of the great presentation of socializing the environment to operators and users. Some of these Examples were provided today.

He further mentioned the other trend on how different platforms interact in the uses of environments in Gamification, transmedia and general trends in gaming, like new technologies and mash-ups as shown by Dr. Garcia with AIMS. More questions came up and could become the focus on the next workshop.

1) The group further discussed the need for measures in the uses of these environments.
2) How do we create a distinction of learning and training?
3) Socialization – what are intuitive changes over time of these environments?

5.13 NATO E-learning –CDR Svein-Inge Sondergaard (RNoN) Joint Education, Training & Exercises Allied Command Transformation

CDR Sondergaard provided the need for change – the training spectrum has to evolve as shown in figure 24 below.

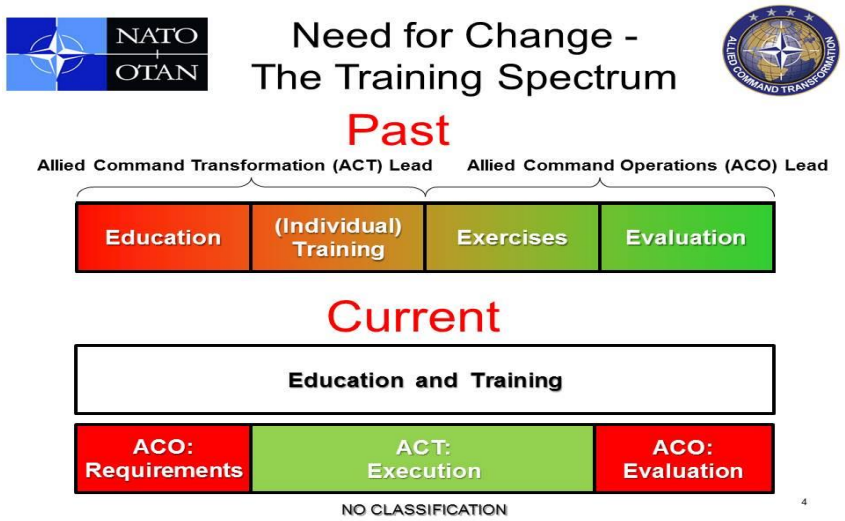

Figure 24: Need for Change – The Training Spectrum

He further discussed how the requirements of NATO Education and training intuitions has increased and leveraging gaming technology allows for more flexibility for the facilities to support centers of excellence and partners.

Figure 25: NATO Education and Training Institutions

CDR Sondergaard gave more guidance on political and military direction and guidance for the operational commander's performance gaps and analysis that is directly tied to quality assurance of the training courses and levels of educational standards.

CDR provided a brief on the present and future technology to support education, training & exercises in NATO, dreams and practicalities. He discussed where we are today as it relates to NATO ACT and the e-Learning Visions coherent approach

"e-Learning as an innovative

and powerful method of teaching and learning,

directed, coordinated and promoted by ACT at the

Strategic level, whilst delegated to the most

appropriate ETF to produce, develop, deliver and

maintain effective, relevant and high quality courses"

CDR showed some examples of integration of live training, man to machine interfaces and how we get there. He mentioned that in order to get to these immersive environments we need to have senior leader buy in enter the Joint Force Trainer Role at NATO ACT new post established in 2010:

- Break the "old model of NATO ETE" (Education, Training and Exercises) Re-think the objectives, capabilities and needs. More effective both in cost and achievement.
- Utilise modern technology to assist in:
  - Individual Education and Training (eLearning, Immersive Learning, Mobile Learning, Small Team Training)
  - Collective Training – Distributed Training, Simulation, replication as near as possible of operational situation
  - Immersive training environments current projects
    - VBS2 NATO
    - Borders Ahoy
    - Village survey

He also gave more details on the immersive training environments as it relates to future considerations.

- Study ITE products and national assessments to capture metrics and seek "value added" to using this technology.
- Work with industry to evaluate current capabilities and joint efforts.
- Work with NATO and nations to increase use of distributed training to meet Connected Forces Initiative goals.
- Increased cooperation with nations IOT share assets and development where possible "learn once and share" across NATO and partners.

He concluded with the need to cooperate with industry and NATO partners on the uses of commercial games for uses in E-learning and other immersive environments.

5.14 Social and Casual Games – Stu Armstrong – QinetiQ

Mr. Armstrong provided a presentation on "so, what's social gaming?" –

He provided examples of acquisitions in the past:

- In November 2009 Electronic Arts acquired Playfish for $300M at the same time as announcing a global layoff of 1,500 employees
- In July 2010 Disney acquires Playdom for $564M
- 2011 there were over 20 mergers & acquisitions involving Facebook game developers costing in excess $1.7billion

He further gave the example of Farmville and its rapid growth, as well as

Angry Birds – 30 million players a day and 300 million hours per day spent playing.

Below he provided a screen shot of Zynga Inc. Stock and its decline in 2012 to wonder if that fad is over. See below.

Figure 26: Zynga Inc. Stock Decline

This is just an example. So is the FAD over for casual games?

He further gave an example of Foldit, a social game that enables the ability to do protein folding, and the results were used to help them solve problems of a virus using game play that was extremely successful as shown below.

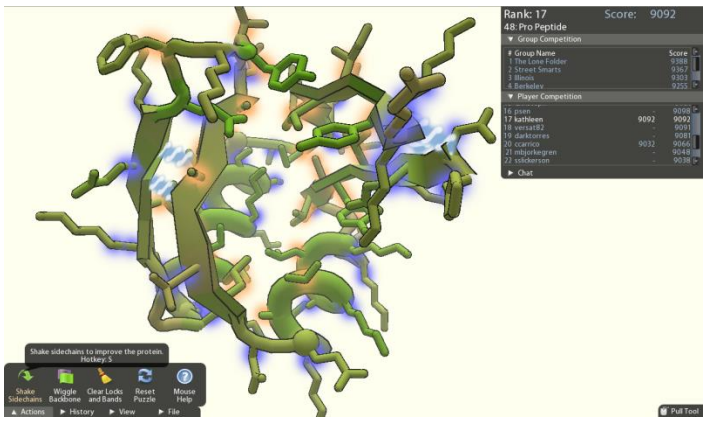

Figure 27: Foldit

He gave some examples of wowwiki – and WoW videos learning and training on how to win in WoW. He showed an example of WoW .
He discussed the use of game play for use in the potential spread of infectious diseases, and used the example in EVE.

Stu concluded that he thinks it is not a fad of the fading casual games fall in revenue development. Social games – "curiosity" is an example where all you do is click the screen. It's a very boring game but it's been used by 1.5 million people in the first week.

Recap from Wayne Buck, Stu Armstrong, Dr. Johnny Garcia and Dr. Elaine Raybourn.

Discussed the event for spring 2013 and opened up the floor to the audience.

Ideas for structure of future workshop

1) Generate more ideas and issues/uses to work on like structure design and metrics for planning – have more time for syndicate groups;
2) Validation of the gaming applications;
3) More technical discussions in future workshops;
4) Continue to push the idea of serious games as a capability;
5) Would like to know who is the main provider of serious games;
6) Aid the Military in how to manage this technology to create an educational path in order to use serious games;
7) How to use serious games in Concept development and experimentation; and
8) Users of the technologies need to be invited to workshop.

6.0 CONCLUSION AND RECOMMENDATIONS

During the course of the workshop, several themes or "hard questions" were identified including:

- Validation and Measures of the environments and how its making a difference
- Workshop intent and purpose – What will the NATO nations do to exploit new technologies and commercial games that they learn about at the workshop?
- Changing environment – The focus on the use or potential use of new technologies is changing, but how are the governments and industry going to adapt?
- Workshop plug-up – There is a desire for the government to see working demonstrations, and a desire for industry to meet a plug-up challenge.
- Use of trans-media in the development of content and leverage user developed content.
- Publish our findings of workshops in formal conferences like IITSEC, SISO, and GAMETECH ETC.

6.1 Conclusion

Participants and workshop organizers assessed this session of MSG-114 as a success. The workshop met its objectives:

- provide demonstrations and presentations to explore uses of commercial games and technologies in support of decision support, training, educational concept development and experimentation
- provide updates on the nations' current application of commercial technologies
- provide capability briefings

NATO partner nations currently use commercial games and technologies. The workshop participants concluded that a need exists and to continue pursuing commercial game technology solutions. This may require review of existing acquisition and procurement guidelines.

Finally, NATO and ACT enjoyed an organizational infrastructure and innovative partners to facilitate these types of workshops in the future. They should continue to do so.

6.2 Recommendations

As noted in the closing discussion, gaming technology has been proven to enhance operations. The workshop focused on providing examples of these transformational changes in NATO nations and organization and shows that serious games are the future, and the workshop has provided value and should and will continue to do so.

MSG-130 - Exploiting Commercial Games and Technology for Military Use in NATO (in the Maritime Domain) 13th Workshop

(STO-MP-MSG-130)

Executive Summary

The commercial and government sector is developing many of the key technologies and applications that have the potential for cost-effective adaptation for defence exploitation and use in modelling and simulation (M&S) applications such as defence planning, training, operations, medical training, manufacturing, and capabilities development. The exploitation of commercial and government technologies and appropriate use of open standards can provide efficiencies and increased benefits for NATO applications. There is a need to identify those technologies having the greatest near term potential and understand the future trends and developments in those technologies that have potential to meet future NATO requirements. The technological advancement of commercial games has manifested itself in various types of applications such as serious games and virtual worlds, both of which may have a role to play in support of NATO countries and organisations.

Conclusion

Participants and workshop organizers assessed this session of MSG-130 as a complete success. The workshop met its stated goals:

- Through demonstration, experimentation, discussion and debate, attendees will acquire knowledge and experience in the possible topic areas.
- Technical and application briefings and demonstrations on selected commercial technology areas will help the attendees better understand the issues so that they may more properly aid in the development of the strategy for the NATO and the Nations to exploit these technologies.

NATO partner nations currently use commercial games and technologies. The workshop participants concluded that a need to continue pursuing these technologies is essential, but more actions need to be taken in the validation of technologies, education of users, and the evaluation of existing acquisition and procurement guidelines.

Finally, NATO and ACT enjoy an organisational infrastructure and innovative partners to facilitate these types of workshops in the future. They should continue to do so.

Recommendations: Technology has come along very well but it is more than just technology. There are cultural aspects of gaming that should be recognized and studied to serve trainees. Overall, the process is still early for Serious Games and if the focus remains solely on technology, there is a risk of becoming shortsighted. Meanwhile, feedback is a very valuable asset in this current time of Serous Games. Whereas early concerns about Serious Games being harmful has been put to rest, the next line of questioning focuses on the cost and time of games for learning. The group felt it was wise to understand the return on investment and would welcome inputs at future workshops on this aspect.

MSG-130 - Exploiting Commercial Games and Technology for Military Use in NATO (in the Maritime Domain)

Technical Evaluation Report

Mr. Gerald "Jay" Gendron
SimIS Inc.

1. PURPOSE

The purpose of this Summary of Proceedings was to document the NATO Modeling & Simulation Group (NMSG) MSG-130 Workshop on Commercial Technologies and Games for Use in NATO (in the Maritime Domain). Through discussion and debate, attendees provided knowledge and details about others' experiences. Technical presentations, demonstrations on selected commercial technology areas, and tours of local facilities educated attendees, and increased their understanding of the possibilities and challenges of commercial technologies and games so that they are better able to aid in the development of the strategy for the NATO and the Nations to exploit these technologies. The workshop convened from October 9-11, 2013 at The Navy Officer Club in La Spezia, Italy.

2. OBJECTIVE OF THE WORKSHOP

- Through demonstration, experimentation, discussion and debate, attendees will acquire knowledge and experience in the area of gaming in the maritime domain.
- Technical and application briefings and demonstrations on selected commercial technology areas will help the attendees better understand the issues so that they may better aid in the development of the strategy for the NATO and the Nations to exploit these technologies.
- Participants will develop a shared understanding of the issues and opportunities.
- Meeting proceedings will capture the presentations and provide recommendations for NATO and the Nations.

3. SCOPE

This workshop is a continuation on a successful MSG series. This particular workshop focused on the use of commercial technologies and games in a maritime domain. It is a starting point to identify innovative solutions and to define future S&T activities in this domain while gaining benefit from previous commercial technologies workshops. Topics included for discussion:

- How immersive technology could improve capability development in a marine comprehensive framework
- How immersive technologies are being effectively employed in support of training in a naval framework
- What areas of education and training along with exercises can immersive learning fill, and how can we integrate that into educational programs for training the next generation of naval crews
- What are the services and infrastructures expected and required by the maritime user community to get benefits from immersive technologies

- How can simulation and serious games help develop concepts, policies, and technological solutions to deal with evolving scenarios
- How immersive technologies could support the development and deployment of next generation solutions for homeland security
- The application of immersive technology in support of decision-making training in conventional and asymmetric maritime scenarios
- How can instructional designers develop and integrate immersive learning into the formal structural development process for building education and training courses for the naval community
- The application of immersive technology in support of the diffusion of innovation
- Anthologies and/or guidelines that will help policy makers and trainers understand the immersive technology and how their attributes map to specific training requirements
- Creative applications of immersive technology that show promise in support of military training or education
- Moving beyond training to use these technologies in direct support to operations (tactical visualization, course of action analysis, mission rehearsal)
- Measuring the level of realism achieved, assessing the degree of immersion, and determining how much realism is required to meet specific training requirements
- Understanding how immersive technologies can be considered as part of the training development process including training needs analysis
- Cost-effectiveness and return on investment for immersive technology in support of military training and education

This workshop facilitated the sharing of national experiences, explored commercial game technologies, increased understanding of best practices, and identified barriers and solutions for further exploitation. Meanwhile, this particular workshop began refocusing the vision and explored the next wave of questions to support a technology road map for the exploitation of commercial game technologies.

4. WORKSHOP AGENDA

Wednesday October 9, 2013

1330	Chairmen and Host	Welcome to La Spezia and Introductions
1345	Chairmen Update	Chairmen
1415	MOIRE: Virtual Environment for Collective Training on Marine Domain	Agostino Bruzzone, Alessandro Tesei
1445	Technology and Methodology for Building the Virtual Ship	Aldo Zini
1500	Break	
1530	Reducing Time to Market for Training in the Maritime Domain	Jose-Ramon
1600	Creating Products with the Customer in Mind	Martinez Nicola Toniazzi

1630	Develop Software Application in the Maritime Domain using COTS and Games	Lucio Barbucci, Luca Isgro (CBT)
1700	Daily Recap and Daily Adieu	Chairmen
2000	No Host Dinner / Navy Club	Chairmen

Thursday October 10, 2013

0830	Welcome	Recap from Day 1
0840	MyIG and MyOcean3D	Riccardo Rovelli
0910	Using Game Based Simulation for Close Range Weapons Training	James Short
0940	Havok and the Maritime Domain	Tom Gambill
1010	Break	
1030	Marine Training	Riccardo Caponi
1100	The Business Side of Simulaton and Entrepeneurship	Mattia Crespi
1130	Research and Development and Synthetic Policy	Roxane Heaton
1215	No-Host Lunch	
1330	VBS2 Maritime Improvements	Colin Hillier
1400	Use of the Havok Games Engine in Asymmetric Naval Warfare Training	Geoffery Tompson
1430	Hybrid Validation Test-bench (HVT) for Autonomous Systems	Alessandro Cignoni
1500	Artificial Intelligence Software for Expert Knowledge Capture	Claudio Taraschi
1530	Tour: Centre for Maritime Research & Experimentation	For people registered
1800	Tour: MBDA	For people registered
1945	Daily Recap and Daily Adieu	

Friday October 11, 2013

0900	Welcome	Recap from Day 2
0910	Virtual Pilot: Agent-Based Simulation For Effective Training	Karel Van Den Bosch
0940	Haruspex: A Tool Running a Fully Automatic Assessment of ICT Risk	Fabrizio Baiardi
0950	Cyber's Achilles Heel: The Human Operator	Stu Armstrong
1000	MIMOS Celebrates its First Decade	Paolo Proietti
1010	Break	
1030	A Lecture on our Naval Warfare Game	Anders Frank
1100	Platform Defend Game	Fabio Camponeshchi
1130	Interdependencies within the Maritime Transportation Sector	John Milam
1230	Naval weapons training using "Virtual Reality": an Hardware-in-the-loop approach	Davide Corsanini, Fabrizio Sciarra
1200	Wrap Up	Chairmen
1245	Adieu	

5. PARTICIPANTS

Name	*Affiliation*
Matteo AGRESTA	Simulation Team
Alessandro ANCIONE	IBM
Anders FRANK	Wargaming at Swedish National Defence
Spano' ANTONELLA	MBDA
Enrico ANTONINO	NATO CMRE
Stuart Alexander ARMSTRONG	QinetiQ
Lucio BARBUCCI	IBR SISTEMI
Christian BARTOLUCCI	Simulation Team
Lorenzo BAZZARELLO	Italian Navy
Rudy BOONEKAMP	TNO
Agostino BRUZZONE	DIME UNIGE
Wayne BUCK	ACT
Riccardo CAPONI	ECA Sindel
Petit Morris CAROLINE	MOD-UK
Alessandro CASAPIETRA	Simulation Team
Doma CHARLES ZOLTAN	Royal Canadian Navy
Roberto CIANCI	DIMS Genoa
Alessandro CIGNONI	NATO M&S COE
Hillier COLIN	Bohemian Interactive Simulation
Davide CORSANINI	Oto Melara
Massimiliano CORSO	Simulation Team
Matteo CRESPI	Qvit
Claudio CUOMO	Italian Navy
Margherita DALL'ORTO	Simulation Team
Paolo D'ANDRIA	Presagis
Cecchi DANIELE	NATO CMRE
Luciano DATO	Simulation Team
Gough EDWARD	NATO CMRE
Thomas Charles GAMBILL	Havok
Gerald GENDRON	Support to NATO ACT
Sciommeri GIAMPIERO	MBDA
Roxanne HEATON	Royal Navy
Luca ISGRÒ	IBR SISTEMI
Salih Cen KUMASAL	NATO HQ SACT
Piazzabonati LUCA	CAP Gemini
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Kessel RON	NATO CMRE
Riccardo ROVELLI	Antycip
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Mr. TENCA	
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Nicola TONIAZZI	Selex Galileo
Alberto TREMORI	DIME UNIGE
Alessandro VAGLIO	SAIPEM/ENI
Karel VAN DEN BOSCH	TNO
Anne WEINLING	IFMA
Aldo ZINI	Cetena/Fincantieri

6. EXECUTIVE SUMMARY OF PRESENTATIONS

Wednesday October 9, 2013

6.1 Welcome to La Spezia and Introductions by Mr. Wayne Buck and Mr. Stu Armstrong

Mr. Buck and Mr. Armstrong gave an introduction and background of the Modelling and Simulation Group (MSG) series on the use of Commercial Technologies and Games for NATO. This workshop – the 14th in the series – will focus on the maritime domain. Everyone in attendance introduced himself or herself. Many participants were attending their first MSG in this series. A few people have attended previous MSG events in this series.

Twenty-four presentations and two tours are included in the workshop – making this a very full agenda. This MSG started out as a workshop series about nine years ago to look into how small business and government staffs could get their national acquisition authorities to go after small game makers because of the perceived risk in working with small entities. This slowly evolved into what we see today. This background provided a good platform and baseline for all of the new attendees.

Dr. Bruzzone welcomed everyone and noted thanks to the Italian Navy for the use of the facility and to some of his colleagues who are providing administration and logistic support. He provided a brief summary of the Centre for Maritime Research and Experimentation (CMRE) and invited

attendees to attend the tour on Thursday afternoon. He also described the details of the no-host dinner, the lunches available for purchase, and encouraged registration for the tours at CMRE and MBDA Missiles.

6.2 Wayne Buck and Stu Armstrong - Chairmen Update

Mr. Buck provided a short primer on NATO, its members, challenges NATO has with relation to simulation, and solutions relating to the content of this workshop. The period through the Cold War and into events of September 11, 2001, provide a rich history on what NATO has accomplished and been through during its existence – growing from 12 countries to 28 with many over global partnerships reaching as far as Asian nations. ISAF has been a very prolonged event but NATO will withdraw in 2014. This will have a significant impact on the forces of NATO (provided by nations) as well as the structure of training. There have been no major exercises outside of Afghanistan due to the operational tempo. While this has provided the impetus for interoperability, it has made it extremely difficult to have any major exercises. Training is very expensive (transportation, sea movement, etc.) but we know we need to do training after 2014 to maintain the gains in interoperability.

After 2014, we will need to move from operational deployment to operational preparedness. This will come from the Connected Forces Initiative (CFI) to ensure interoperability remains high. CFI has three key areas:

1. Expanded education and training (individual and small group)
2. Increased number of exercises
3. Increased use of technology to support the former two

Much of this occurs in the MSG – and it will continue to focus on these areas. Now, all training responsibility rests with NATO / SACT HQ. In addition to maintaining interoperability, this will support the NATO Response Force. Exercises will help keep readiness high – especially those nations needing more opportunities for experience. Meanwhile on the technology side, the Military Committee gave the command five tasks to look at. This workshop fits tasks 1 and 3: improve education and training and improve exercises. NATO typically trains staff as opposed to troops on the ground and can last over a period of months. Mr. Buck believes games can help with that. Rather than pouring through pages and books of procedures – why not use games that introduce those procedures. Perhaps staff trainees spend an hour at a time over many days – at their desks – playing a game. This is just a different way of thinking.

We have many actors and players in NATO. modelling and simulation There are users, providers, advisors, Centres of Excellence, as well as the nations. There are also many simulations out there. In NATO, there are very few simulations – relying mostly on JCATS and JTLS as well some Bohemia products. We have some local, homegrown simulations primarily in logistics. This domain can get very complex – for good reason. Architectures and technologies change often, adding to complexity.

The group seeks solutions through forums such as this MSG. Mr. Buck described some of the events over the last few years. The group pays attention to standards and interoperability. The group must also watch not only technology but also training personnel. A problem is emerging – we may lose the two primary simulations in the near future. ITEC 2014's theme (occurring in Cologne from May 20 to 22, 2014) is about CFI – "From operational engagement to operational preparedness." NATO ACT will be at I/ITSEC 2013 as well.

Mr. Armstrong recalled that during the beginning of the MSG workshop series in 2004, there were difficulties caused by budgets. This series began to get government and industry inputs, including lessons learned. This helped support the development of VBS1. The group has kept this theme

going – using this forum to share knowledge, see how people are using the technologies, and to share lessons learned. Budget issues have not subsided and technologies are changing at an even greater rate of change. Therefore, this forum is as relevant as ever. The most useful part of these forums is the discussion among participants – both during the presentations and during the breaks. It is exciting to see over 20 papers submitted some 10 years after this series began.

6.3 Agostino Bruzzone and Alessandro Tesei - MOIRE: Virtual Environment for Collective Training on Marine Domain

Ms. Tesei presented the work done on MOIRE as a Virtual Environment for Collective Training within a Maritime Domain. The focus will be on anti-piracy although there are other uses. Another focus will be on intelligent agents. She began with an overview of the training process. Simulations types include live, virtual or constructive. Engagement, fun, and pleasure are important as characteristics of a good Serious Game. There must be a balance between "serious material" and fun. Some drivers towards serious games include fiscal constraints as well as the need to train very large groups. Safety is another aspect that is a consideration – simulations allow for safe environments.

Learning occurs at many levels, from knowledge to more complex skills like decision-making and strategy. Even more complicated is the development of "soft" skills. Serious games offer many advantages:

- ability to make better use of training time
- ability to link many users
- ability to reduce training time
- ability to increase usability
- ability to take training again to improve skills
- ability to measure progress

The systems used are primarily Commercial-off-the-Shelf (COTS). MOIRE is a training solution for navy training and operators of commercial ships. It supports many different types of tasks from ship boarding, use of rigid hull inflatable ships, firefighting, and underwater operations. Skills include two broad areas: learning procedures and developing collaborative skills. Dr. Bruzzone's group has conducted a great deal of research in developing serious games.

Ms. Tesei mentioned a forum called GALA, which is a web-based community that CMRE collaborates with to share experiences in the area of serious games. They discuss available technologies, describe experiences, assess state of the art, and then evaluate the learning impact of games. She invited all to join the community and take part in the discussion.

Dr. Bruzzone discussed the distinction between simulations and games. When we set up an exercise simulation, it takes months and months to prepare the simulation and the people. You concentrate on a two-week exercise followed by a very fast after action review (AAR). The latter is the portion intended to disseminate learning, but often the ending (AAR) is executed hastily. When we discuss games, we are talking about the complete opposite. People are doing this because they are fun and engaging – because they want to play. Improving the learning is the key point – not a quick ending like the AAR. We also see some advantages in using technologies that are a few hundred dollars to engage and really get some learning to take place – replacing things like on the job training or reading manuals.

Intelligent agents are things we have been using over the past several years. The purpose is to have a complex training event without having to seed the game with many "humans in the loop". The goal is to introduce complexity with an appropriate homogeneity for consistency. These agents will provide interesting

experiences. One challenge is in the validation of the use of intelligent agents. Dr. Bruzzone described some current work in serious games to train for terrorist threats and defending against them. The serious game is not just to train but also to collect knowledge. We will put subject matter experts into the game who will serve as a "sensor" to assess the performance of the event. They will be able to extract knowledge based on player's actions. Self-play mode makes it essential to implement intelligent agents.

When the game is developed, it is not very different from the simulation development process at large. Budget remains a concern, but games can be much less expensive. He noted the cost of a Kinect camera is about $80. However, when paired with a game engine that system can be more expensive than some government simulations available. A hybrid of various engines both commercial and GOTS are emerging. Nonetheless, it is important to pay attention to cost when assembling architectures. Another aspect that is interesting about this field is interoperability. One can combine existing sophisticated models. This will require validation. Other systems form with interoperability in mind ranging from anti-piracy to unmanned aerial vehicle.

Dr. Bruzzone then discussed the process of developing serious games. It is becoming refined but it does have areas of difficulty. A good development process can alleviate many difficulties. Take terrain and texture for instance. In the instance of VBS2, the process begins in 3DS Max and then worked through some intermediary tools to ultimately have a VBS2 item. Anti-piracy applications demonstrate some success because the measure of performance was visual identification – making the quality of the texture important. The implication is that there is a great deal of utility for training.

A number of considerations must be kept in mind when developing games. Scenario manipulation must be easy. Stress effects on the trainees have impacts just like in reality. The upside is that the experimentation at CMRE is yielding some data that shows the effectiveness of the games as compared to traditional training. As noted by a member of the audience, this has proven to be difficult and return on investment is very often a question asked of new technologies.

6.4 Aldo Zini - Technology and Methodology for Building the Virtual Ship

Mr. Zini presented his work of melding technology and methodologies of shipbuilding in a virtual space. This includes not only shipbuilding but also ship use. Ships are a System of Systems – very complex to design, build, and operate. Ships must struggle against environments not typically hospitable to the ship. This has resulted in a reliance on master ship builders to work with all the effects and design ships accordingly. Simulation (and testing/validation) are part of their tools. Nonetheless, some things accomplished manually are things M&S supports well.

Mr. Zini then discussed the role of M&S on an organizational level. For instance, two different divisions within the shipbuilding operation sometimes do not have clear insights on what other divisions are developing. Advanced use of visualization approaches can provide a near-real time insight as to production status. Visualization offers many benefits:

- ease of use without a great deal of training
- explore alternative possible outcomes and choices in design
- verify a requirement in extremely dangerous situations
- provide a more engaging way for builders to work with customers during reviews
- conduct as much review prior to cutting metal – reducing costs

As mentioned earlier, the use of simulation is critical in validating how the ship operates in a manner expected in many conditions that do not necessarily fit testing schedules. These validated models are also

useful in training and exercises – allowing collaboration with other NATO nations. Additionally, the simulation enables assessment of port capability.

Some obstacles exist. Cost is a consideration, but leaders may view them in terms of the overall cost of the ship building process. Unfortunately, the current culture is to keep the familiar and remove the new. Simulation is often the victim of cost cutting drills. Another obstacle is the concept of using games in such a serious operation. However, games have shown the utility of games in many phases (design, build, operation).

6.5 Roberto Antonio Naretto - Reducing Time to Market for Training in the Maritime Domain

Mr. Naretto presented an overview of the M&S Suite 13 product line available from his company, Presagis. The de facto standard for 3D modeling is Creator. It is also useful to output models in a number of formats for other products like VBS2 or Collada. Creator 13 has really increased the usability of the tool. Terra Vista is a terrain-modeling tool that supports many products like VBS2 and others. The current goal is to simplify terrain generation so non-experts can perform the function.

With Stage, he described it as a means to address differing needs from training to tactics. It provides the capability of a scenario editor and ability to work in an open environment with many architectures. With Vega Prime he noted improved effects (especially for maritime). It is really a toolkit. It is a closed – not an open – solution. It is completely customizable to fit customer need. It can also handle large areas in a database. The remaining products presented support the graphical interface. Developers can write them for use in real systems and platforms as well as on PC simulations.

The benefits of using the suite of software is saving time, reuse of data, and saving money. Use of the full suite does not lock users into a permanent relationship with Presagis because it works and integrates with many other widely used products. They now offer a new licensing policy that may be interesting to members of the audience.

Mr. Naretto did provide some particular use cases of how the M&S Suite creates maritime environments ranging from ship pilots to navigation training to mission training. The success of the past has been by providing a core technology and not the end products/end-user applications.

6.6 Nicola Toniazzi - Creating Products with the Customer in Mind

Mr. Toniazzi looked at the productivity aspects of developing training for maritime customers. The aim of the project is to enhance training in multi-force operations where a great deal of collaboration is required. One of the key benefits is that using the tool allows the reuse of the same scenario to multiple people to assess the true impacts of the training based on procedures. All data is recorded and available to the instructor. The instructors are interested in increasing training readiness.

Tracking Operations are a focus of the discussion. In the use case, they have employed two simulators for rotary wing assets. This enables trainees to operate the rotary wing craft in synthetic environments to practice tracking operations. The architecture based on VBS2 allows multiple players to see each other in the scenario. The other function is a communications mechanism to allow for interaction. They are validating the ideas by engaging with customers and performing technical assessments.

Mr. Toniazzi then went on to articulate the process his firm uses to engage with customers by presenting a series of questions relating to the form, fit, and function of the product with respect to the customer segments. Additionally, he highlighted the importance of understanding and communicating cost to the customer and organisations. Finally, he talked about how they are assessing the effectiveness of the product. This is not trivial and is a very important component of bringing the product to market.

6.7 Lucio Barbucci and Luca Isgro - (CBT) Develop Software Application in the Maritime Domain using COTS and Games

Mr. Barbucci opened the presentation with a video to serve as a case history of the company and their relationship with the market. The main area of interest includes engaging simulations that are cost effective. Their presentation of core capabilities served to establish a foundation for the context of the technical work presented by Mr. Isgro.

Mr. Isgro provided a technical presentation. Their history goes back to 1999 and includes one of the first uses of video gaming workflow in military training. Their core concept is that the simulation should emulate reality to the greatest extent possible. This requires a great deal of physics-based calculations regarding reflections, collisions, visibility, and all other elements. These all existed in video games. Their product, the Joint Tactical Theater Simulator (JTTS), is a multi-domain simulator from land to sea and air. The utility includes antipiracy, antiterrorism, ship boarding, collaboration.

JTTS is a complex suite of other simulations. The motion platform, for instance, reproduces stresses inside the training environment. This platform is fully controllable by the instructor. Mission planning and mission review are also functions for the JTTS. Developers use an object-oriented language to modify scenarios. Meanwhile, they are integrating JTTS with VBS2.

6.8 Daily Recap

Mr. Buck gave a brief overview of the purpose of the recap – noting they are looking for trends and general observations. Mr. Armstrong facilitated the recap noting a commonality in the day's briefings – specifically the technologies are coming together. From an industry perspective, what are novel approaches to these? Where are funds most effectively spent? What should we build that we cannot do live effectively or cheaply? A few key points:

1. We know we can do this – though we need more metrics and a good use case.
2. From an industry perspective, having seen training systems for the last 20 years the technology is available to everyone – not just the big companies. So where does business go over the next 20 years? We have lost the technology edge so what will become the value proposition? Is there a value added or will this business go small business/lowest price in the future?

A discussion ensued about the aspects of games, serious games, gamification, etc. The key point is that culture has a very strong impact on how games are accepted and used among the users. For instance, the word gamification was only used once today – a large difference from last year in Genoa. If you throw away all of the technology can we still use games to accomplish training? History has shown the answer is yes – used over the centuries and is the root of wargaming. Therefore, we have evolved to associate serious gaming with technology and not thinking about what immerses people. There is some research in the UK as to what motivates people to play games? Do people learn as a side-benefit of a good game or is it necessary to have pedagogy in mind?

The day ended and participants were invited to the non-host dinner event at 2000.

Thursday October 10, 2013

6.9 Recap of Day 1

Mr. Stu Armstrong gave a recap of the use of serious games in the maritime domain. He reminded attendees about the tour this afternoon and reviewed transportation logistics. Given the full day ahead, Mr. Armstrong quickly began the day's presentations.

6.10 Riccardo Rovelli - MyIG and MyOcean3D

Mr. Rovelli provided an overview of ST Engineering, based in Singapore covering many domains including Maritime. They are a growing company. The Antycip simulation division works on electronics ranging from large-scale systems, communications and sensors, and software. Antycip HQ is based in the UK. They also have a maritime group that designs and constructs vessels as well as ship repair and conversion. Antycip simulation began in 1996 in France and continued to grow operations around Europe through 2007. ST Electronics acquired Antycip in 2008. Three Area Managers are regionally aligned – the key operation in each is support.

Their core capability is to distribute a COTS product integrating source data selection and optimization as well as automated terrain database generation (such as .SHP files). Another core area is 3D modeling in real-time. In the terrain generation tools and services, they also have a runtime engine for visualization (a family of products). Their networked simulation, scenario generation and execution work over many platforms and clients. They are developing plug-ins for the various domains based on demand from marketplace. Mr. Rovelli discussed the work done in simulation and stimulated communications to simulate data links and look at excursions based on conditions.

Mr. Rovelli presented MyIG: a CIGI compliant GP image generator. Key features include six degree of freedom motion simulators. Architecture is broken into clusters allowing easy integration through their API. Advanced features include shadow, blur, and other effects. They also have MyOcean3D for motion oriented maritime simulation. It is open source software using physics based research. A key feature is the visual effect of waves as they interact with the coastline features. A next step is to attach the sensor simulation.

6.11 James Short - Using Game Based Simulation for Close Range Weapons Training

Mr. James Short discussed Close Range Weapons Trainer for close range training of weapons operators. It represents a good mix of serious games and use of visualization. Flexible, reconfigurable and expandable capability allows for individual and collective training. In the past, they had one room for multi-use training. Now there are multiple rooms for different uses. It runs on VBS2 and includes other platforms to provide a more precise system that gives feedback and integrates communications.

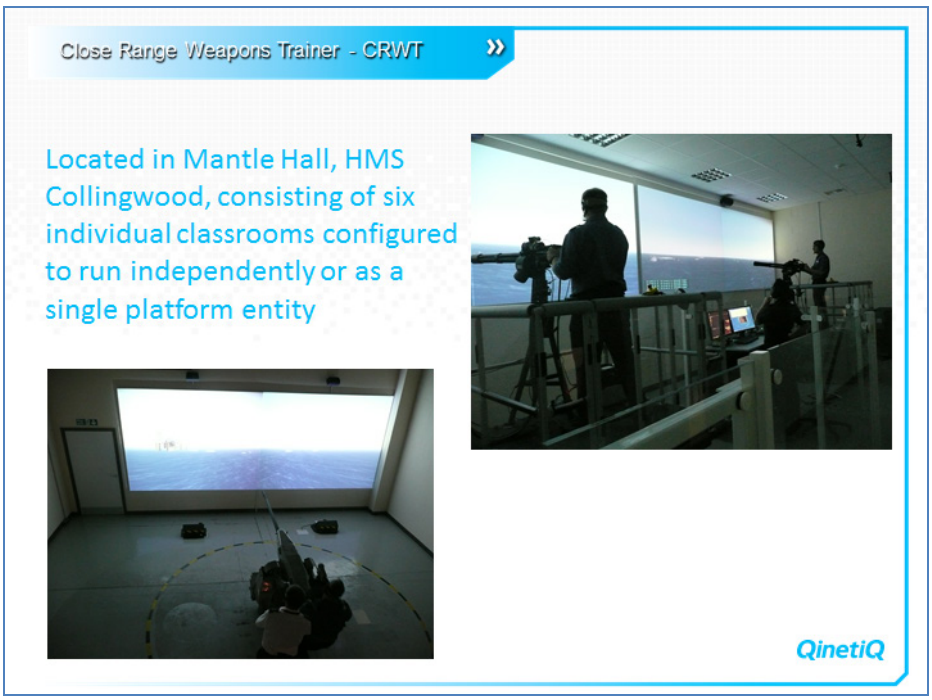

Figure 1: CWRT Facilities. Two of the classrooms where the CWRT is in use.

Figure 1 provides a visual feel for the CRWT facility in Mantle Hall, HMS Collingwood. Key features of the CRWT include:

- Proven COTS technology was used
- Engaging, effective training experience – cost avoidance of using deployable floatable targets and the ability to simulate various piracy situations. Some of the weapon stations are equipped with three degree of freedom to replicate some type of motion of the host ship. Very realistic weapons with laser and haptics incorporated – include ability to incorporate 'jams' and 'stoppages'
- Individual training – integrated with instructors to shape the training based on operator need. Have capability to train on GPMG, minigun, 20mm and 30 mm cannon
- Collective training – VBS2 multiplayer capability allows individuals to tie-in for combined training
- Reduced operations risk/cost – use of COTS hardware and software provides a low-risk approach to the delivery, maintenance and upgradeability of the system
- Adaptable for future training needs – very adaptable because many, many people know how to create scenarios and adding threats or waypoints on the fly. Brand new scenarios can be developed in just a few days
- Interoperable – VBS2 is HLA and DIS compatible

Overall, CRWT demonstrates utility of COTS games/technology to real world military training. Additionally it shows an ability to interface gaming technology with other hardware and systems. Finally, military training operators can adapt to using COTS technology for effective training.

6.12 Tom Gambill - Havok and the Maritime Domain

Mr. Gambill gave a short overview of Havok including capabilities, scope, and growth. He described the basic components of the Havok suite and many new customers who find it easier and cheaper to use the COTS solution than construct their own. He then gave an example of a crane simulation based on the physics engine.

Havok ocean simulation features:

- 60 fps+ in real application on consumer-level hardware
- Dynamically scalable from 1 square km to 10 square km
- Sea states can vary by location
- Surface details: foam, wakes, reflections, etc.
- Underwater and infrared sensor view

GPU based visual simulation based on DirectX 11. It is a completely deterministic simulation as well as multi-channel support. Parametric Gerstner – "sum of sines" provides single GPU adaptive Tessellation Mesh (2M+ simulation points per frame with 20km+ view distances). Local wave areas may have different sea states than the global ocean (trench, reef, wind area). Seamlessly blended with the ocean, it supports random surface foam and whitecaps using wave physics. Ships and buoys leave foam trails. Graphic artists define the start point then the engine fades it over time.

Primary and secondary wave trains exist in the model (height field textures attached to bow; move along ocean surface with ship). Spray effects occur in real time by calculating the friction of surface and water based on "probes" located on the moving object – this also works for surfacing vehicles. None of this is canned animation. Particle effects show effects from thrusters. All these effects are applicable to anything that intersects with the water. Lighting effects include reflection, refraction, and underwater light absorption.

The engine also supports infrared solutions – whether that is organic simulation integrated into Havok or developed in Havok. Some of the newest features include Round Earth and Ice Breaking.

6.13 Riccardo Caponi - Marine Training

Mr. Caponi discussed the Mars Line for use in ocean simulation. Established in 1982, the company supports many navies around the world. Their three main philosophies are reliability, modularity, and COTS based. Architecture allows designs of systems that can start very simply and expand over time. This is a cost effective method for many customers. They are compliant with HLA and DIS protocols. The model operates at three levels:

- Scenario level – applications for weapon manager, instructors, etc.
- Engine level – does the calculations like gun, optics, communications, radar, etc.
- HMIs level – handles the human-machine interfaces

Mr. Caponi provided an example of fully developed system architectures to demonstrate the three levels described (see Figure 2).

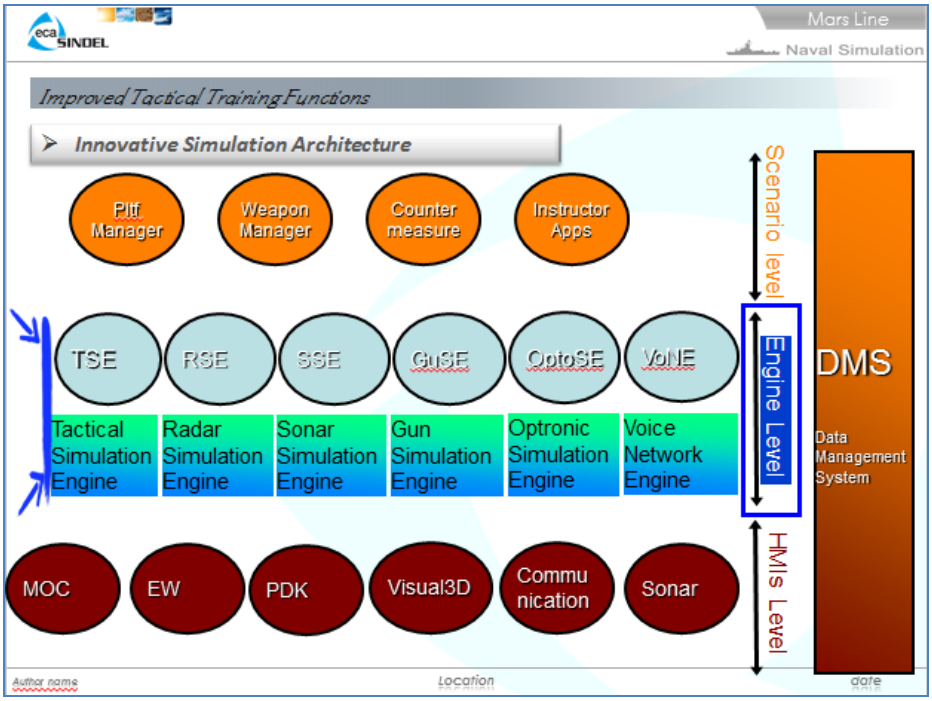

Figure 2: Innovative Simulation Architecture. An approach to tie many protocols together.

The system allows a host of experiences ranging from individual to platform to multi-platform training. It also allows scenarios from tactical to strategic levels. Mr. Caponi provided details on a number of specific trainers:

- Anti-sub Warfare Team Trainer – multi-platform simulator
  - Many platforms including air and sea systems
  - Includes debriefing room
  - Faithful replica of the consoles

- Submarine Team Trainer – used to train crews of this new platform
  - Includes four multi-screen; four single screens and plotting station
  - Very compact and flexible
  - Reconfigurable to training needs (standard, all sonar operators, tracking, or sub-on-sub)
- Naval Combat System Team Trainer
  - Full replica of Thales Netherlands TACTICOS Combat System
  - Used for Anti-Air and Anti-Sub Warfare
  - 12 multi-configurable consoles
  - Many systems simulated ranging from radar to guns to torpedo
- SimulNav NG (French Navy)
  - Includes several installations to satisfy various needs
  - Large system to simulate the working stations of various naval platforms
  - Includes horizontal plasma screens to simulate the view of water to aid in mooring
- Addestratore Avanzato (Italian Navy)
  - Simulation for new system coming online
  - Complete replica of the overall platform
  - Also has capability to simulate different types of ships
- CRISIS Management Simulator for Brazilian Navy
  - Focus on sinking, search and rescue, oil spill, etc.
  - Many stations to address many different functions
  - Enables planning, execution, and debrief of events
- Database Management System
  - Holds the data for the system
  - Showed the interfaces of the system to input data and view calculations

6.14 Mattia Crespi - The Business Side of Simulation and Entrepreneurship

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Mr. Crespi discussed some future views covering the next 10-20 years. His presentation material comes from the research accomplished by the Institute for the Future (IFTF) in Palo Alto CA.

The current age is one of Big Data based on elements like mobile devices, sensors, social networks, and intelligent interfaces. Mr. Crespi categorized the data available from tine world in four different dimensions: planetary, cities, people (social network), and microscopic. We are able to see world through these four dimensions in scales and bring all this data together to better understand how things work. We are taking lessons learned from the internet to redesign our whole world like designing smart cities. The internet is in a way becoming more and more human. We initially designed the internet as a means of communication: exchanging data, numbers and text. Now it represents multimedia, videos, sound, music, and, in a way, it is becoming more human and reshaping the way we live our societies, our work and how we connect with one another – the human internet.

We truly understand how our ecosystem works – people, plants, and animals – and we are creating a world where living and non-living things are connected. This is the coming age of the internet – the Internet of Things (IoT) – and it will last for the next ten years.

Mr. Crespi began his discussion about the IoT by showing a picture of how Google Car sees the world. It is very different from how we humans see it. He then took the audience on a journey to look at some of the mechanism that characterizes the IoT:

Human task routing - essentially deriving from crowdsourcing, but allows us to source people, systems, and tasks where you need them and when you need them. For instance, *MobileWorks* is a task platform where you choose a task, price it, and runners find someone to accomplish the task. You pay when the task is completed. Other examples include *GigWalk*. You tell the platform what your business needs right now and where. The internet will find people in that location and will assign them tasks. Meanwhile you get real-time data, confirmation, photos in your email. This is very useful for marketing. It can change the way you are promoting things.

From "crowd sourcing" to "here sourcing"…destroying distance and hyper local awareness. We see applications like *PulsePoint*. It is an iPhone app, which allows people with heart diseases to be registered and press a button if they have a problem and CPR enabled assistance, can immediately find you and assist you.

We have the future of moving things called matter routing. This term comes from the days of routing data, but now we will route things like automated drones to bring medicine in places dangerous to reach.

We are changing the way we gather and meet. We are creating "do-ocracies" (the first platforms for self-organizing and make groups of people take coherent actions around something, for example, *Liquid Democracy* is an internet participatory democracy. An example of this is in Italy during the campaign "5-Stars" where they exactly matched their capability with real live activities in the squares and pushing the model to get people to participate in decision-making.

We have social bot swarms. We are building autonomous algorithms to go around social networks and collect followers to catalyze interactions. We have more complex algorithms like narrative science that are able to gather text from different sources, put it together, and rewrite an article that makes sense – very powerful.

All of these things and new structure of the internet implies realignment. An alignment by all our organisations the way we think, work, live, our creativity…how we organize all this…policies. This would include topics like citizenship, learning, community, communication, manufacturing, and logistics. We can now put together products by buying pieces from around the world and assemble at the final destination.

All of this composes what we call the Human Internet, or the Internet of Things. More examples:

- Interaction improvements: through emotion, motion, and movements
- Total recording and transcription: for example, *Lifelapse* is an application where you put your phone in a pocket and takes pictures every 30 seconds recording steps of your life. One gentleman has the first documented repository of how we learn by recording childhood from 0-3 years old
- Algorithmic arms race: predictive software that regulates actions in the stock exchange where we had a "flash crash" where $100M's were lost due to bad data; Polyworld. It's the first environment to allow artificial intelligence to evolve and develop
- Digital cognitive networks: we are understanding how patterns are designed and learning amazing things like neurons are alive; IBM is working on the first cognitive computing devices
- Energy efficiency engineered: *Greenlight* monitoring system that visualizes and suggests ways to reduce the carbon footprint and use of machinery and energy; Georgia Tech has developed transparent, flexible device to scavenge energy from particles in the ambient and store it to create electrical energy

- Cybersecurity: *PittPatt* is an example of first software development kit to enable open source facial recognition into any application – free to use for anyone; Digital ants is a cybersecurity program. They move around network to find and fight viruses but they also leave 'digital pheromones' so nothing arises there in the future.
- New operating systems for personal data: *DIDATA* the UK government is working on voluntary program to create a mobile device to store all personal data; *DATABANKER* is a tool that tells you how dangerous it is for yourself the data you share on social sites
- Seamless and intelligent devices: the ability to simply transfer content from any device to a screen such as the Samsung smart window which is able to convert any window to a touch screen
- A large number of autonomous web applications: enable users to integrate a type of interoperability through algorithms
- People as Peripherals: *Soylent* is a plug in for word processors invented by MIT that permits users to insert writing written by others on the fly while you are writing a paper. If you would like a paragraph on the history of NATO you can ask people to create this and send them to you so you can evaluate which one is better to fit in your document

This is the Internet of Things, which is happening now and over the next 10 years. It paves the way to the next era, which we call the Era of Networked Matter.

Things become rather strange in this era because the difference between atoms and bits is becoming less and less. Imagine a world where everything is connected. There is no difference between artificial and biological. Mr. Crespi showed a picture of a tree, but it is more than a tree. It is a very powerful sensor to help us understand how the air around us is polluted or clean. In other words, this is the best sensor we have already available to measure the quality of the air we breathe. However, we are building artificial sensors to do that. Why? Because the tree has all the information inside itself but the problem is, we do not know how to extract its data. We do not speak the same language as the plant, but we know there are patterns within the plants that allow communication between networks and they carry the information on our ecosystem better than anyone else does.

This tree represents but one example. Here are the four scales presented earlier to see how things will change:

Planetary scale:

- We have the space junk map. We have a problem with space waste. We have satellites in danger by space waste. This project from the *US Space View Project* is to protect satellites in space
- The *Atlantic Rainforest Network Project* to understand how networks of plants communicate with each other and what information is retrievable from plants
- Mobile tsunami sensors as we learned we can get more precise predications on where tsunamis are likely to happen if you constantly measure data using ships that move around the oceans. If you can merge and cross this data you have a better prediction
- Google drones working in partnership with the World Wildlife Fund to monitor species and using drones and RFID technologies to monitor groups of animals likely to become extinct and learn ways to protect them

City scale:

- IBM designed Istanbul's public transportation network. What is interesting is it is the first network designed by taking data from mobile phones and social networks. They used geographic data and information social networks to redesign the transportation map

- Weightless Special Interest Group is developing a new chip for new low frequency waves to allow certain data analysis
- New York University Center for Urban Sciences: actively studying evolution models of smart cities
- *Munisense* is an urban sensor network that allows the measurement of anything happening in a smart city at the infrastructure level like energy, transportation, or water

People scale:

- Birmingham University has built the first predictive software based on social networks and mobile phones to predict the movement of people for given areas
- *DRM (digital rights management) Chair* is an effort by Swiss students and is a chair that destroys itself after eight uses. It is a statement about digital intellectual property and the problems we face
- *Cathaphora* is a system that constantly monitors and studies the behavior of people in certain areas and creates clusters of people and highlights where disorders are likely to happen in an urban to act in advance
- *MyRobots*: the first Facebook for robots. You can register you bot provided it connects to the internet and it will send data to the social network where other bots will make use of it

Micro scale:

- *BRAIN Project*: brain research through advance in neuro-technologies to fully map the brain
- *Project Cyborg*: on Autodesk using CAD to design modifiable matter like the change of state in matter. In the future, designers will design objects that will change properties according to outside conditions or properties we give them
- *BIOFAB*: international open facility advancing biotechnology with public DNA sequences in a repository so they have the latest data
- *Millimotein Robot* from MIT: the first robot that changes its state and shape and properties according to what is happing around it

These are just some of the things that will happen in the coming years and bring great changes. Imagine a world where you can manipulate matter. For instance, 3D printers will be able to print not just objects but also a vegetable or any type of living organism such as organs on demand.

In conclusion: this Era of Networked Matter is an era of great opportunities, daunting pitfalls, and great weirdness.

6.15 Colin Hillier - VBS2 Maritime Improvements

Mr. Hillier gave a brief explanation of Bohemia Interactive and overview of VBS2. The latest add on is TerraSim. It allows manipulation of a large amount of data – not only to use but also to push back out. Focus of talk was on two areas: maritime and VBS3.

VBS2 Maritime Capability added many new views for different functions as well as visualizations. A lot of the success is based on the open community and hard work of the engineers to model the physics of water. Scuba diving and moving from sea to land is a key new capability of the maritime capability. Wet docks are available as well.

Physics improvements take a while to get the buoyancy characteristics right for various ships. How does the mass difference among compartments affect the motion of the ship?

Use of proxies has broken the limitations of the number of polygons available per scene. In other words, building a single fire extinguisher proxy represents the 400 units needed on the ship. This removes limitations of the software – machines and processing are the new limiting factors.

Bohemia delivered VBS3 to the US Army with roll out in early 2014. They estimate issuing 40,000 licenses each calendar year. New features include:

- Size of terrain
- Bigger battlespaces
- More individual interaction
- Modular approach to enable scalability
- Allow multiple computers to handle the calculations
- Support for multi-cast for further network optimization
- Improvement of the VBS open architecture – plug in based architecture; reuse
- Modern User Interface – more logical and easier to read
- Suppressive fire
- Snow layers – effects on movement, speed, and how units and equipment sink
- Pattern of Life simulation – "crowd ambience"
- Launchpad – to better enable network maintenance
- Biotopes – procedurally generated terrain features created algorithmically
- TerraSim - TerraTool Integration – improved generation of complex terrain
- Inverse Kinematics – precise hand placement, door handles, hatches
- 2D Map Redesign
- Destructible buildings – Nvidia PhysX Apex Destruction; different each time
- Improved graphics – the goal of making things look very nice; creeks, rivers, particle effects, ambient life (insects, ambient environmental sounds 3D cloud Simulweather
- Improved Artificial Intelligence – get collisions working properly
- Better animations
    - Change uniforms, gestures, finer animation steps
    - Improved mine simulation, animation interpolation
    - Parachuting, particle, ragdoll animation
    - Rendering and lighting
    - Slots on weapons, swim and dive, UAV enhanced, and weapon simulation

6.16 Roxane Heaton, Research and Development and Synthetic Policy Staff Officer; Maritime Training and Acquisition Organisation (MTAO)

LtCdr Heaton discussed the barriers, challenges, and opportunities as well as a way ahead. She began by noting that although the Royal Navy has VBS, it also has many legacy systems of which the Royal Navy does not own the intellectual property. There are a number of military drivers towards the use of synthetics:

- Immersion
- Blended
- Investment
- Reuse
- Deployability
- Interoperability
- Optimum us of technology at the right place and time to increase operational capability

This all provides a better understanding of many things and is important for adapted force structures to provide a more agile force. Another area of interest is managing content for mobility (computer aided instruction, mobile learning, and concept demonstrator)

- Security is a continued issue
- Ecosystem – specifically the software
- Networks: ship to shore, shore to shore
- Distribution of training
- Intelligent creation of content for training transfer (e.g., gamification)
- Standards

LtCdr Heaton highlighted a number of current challenges:

- Culture
- Risk
- Educating audience/users
- Technology building vs. lure
- Connectivity and security
- Human factors
- Evidential training benefit
- Recruitment and retention and reserve forces

LtCdr Heaton provided data from Gartner Consulting noting, “80% of games fail to meet business objective primarily due to poor design.” Meanwhile, the use of 3D visualization successfully helps train new recruits to navigate around the ship. This is most helpful when those who have never been aboard a ship face their new mission sets – at night – with full gear. Their performance can improve if they understand how to navigate around the ship. LtCdr Heaton expounded on a number of opportunities (as shown in Figure 3) including data indicating an operational improvement from 30-50% due to the technology such as marksmanship and smalls arms training, respectively.

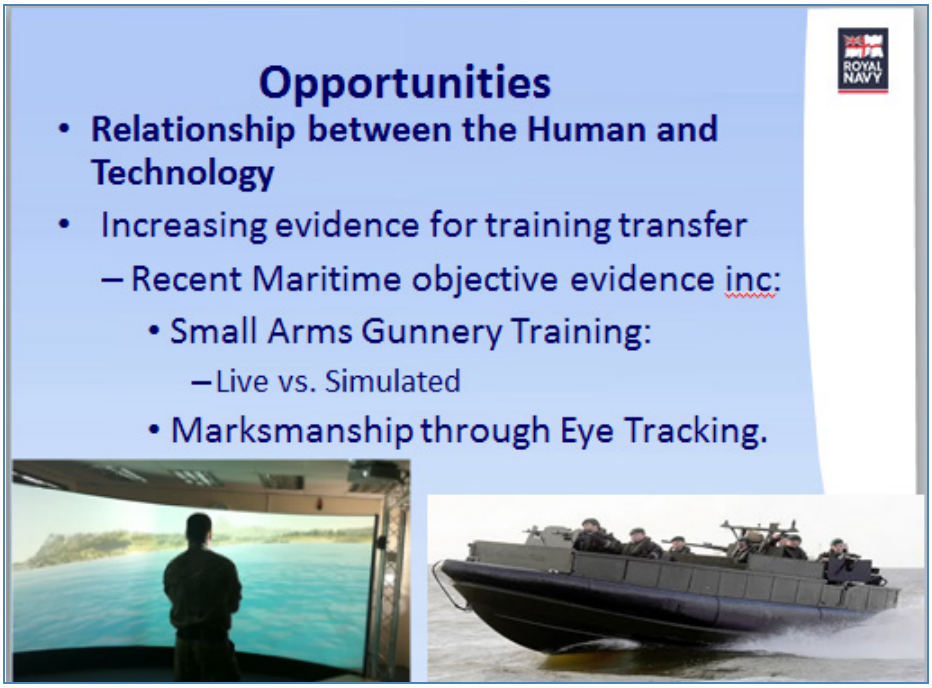


Figure 3: Opportunities. How simulation may help training in the maritime domain.

Other topics noted:

- Ways to achieve immersion
- Low to high motivation vs. low to high ability is the goal
- Learning how to optimize the immersion to maximize motivation and ability
- Fidelity: motion, all senses, and psychological

LtCdr Heaton noted another future opportunity, the Defence Training and Education Capability Programme, which is available online. It is a programme focusing on exploitation of modern simulation to give better training at reduced cost. One such project was the pilot Defence Simulation Center (pDSC). It managed to save £2.6M. It serves as a data repository and a place to design.

Her organization (MTAO) was set up to acquire and support training through best practice. Policy is still a need area. Lastly, human factors lie at the heart of the focus.

6.17 Geoffery Tompson - Use of the Havok Games Engine in Asymmetric Naval Warfare Training

Mr. Tompson discussed the use of Havok Games in naval training, specifically to train for asymmetric threats. Current naval platforms have a powerful capability, both offensively and defensively. This leaves the enemy to counteract the power with asymmetric approaches such as mine warfare, suicide vessels, and fast inshore attack craft attacking in a swarm. He stated the problem as many navies are adopting a myopic view of the asymmetric threat posed by swarms of fast attackers.

Although the area of coverage (defensively) is about 2km, the area of concern is beyond visual range. Mr. Tompson noted there is a false premise that nothing can get close enough to the naval vessels to be a true threat. The real threat was explained as (a) close threats (suicide boats, RPGs and mines); (b) near threats (unguided rockets and torpedoes); and (c) far threats (guided anti-ship missiles). This requires a training

philosophy that presents a layered defence. Figure 4 provides a graphic representation of the threat environment.

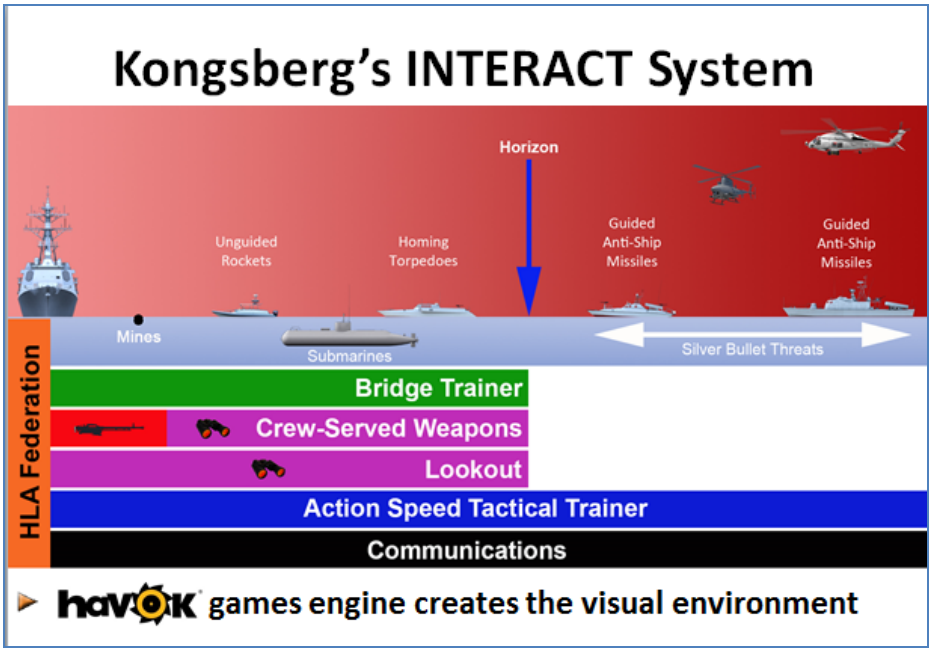


Figure 4: Maritime Environment. Shows the danger areas for large ships at sea.

One must not ignore threats. Rather, consider and engage them as follows:

- Close threats: by crew served and remotely operated close in weapons
- Near threats: using own ship guns and guided weapons
- Far threats: by main guns and guided weapons using third party targeting and possibly by arm UAVs
- Threats beyond the range of own ships would be engaged by helicopter or UAV

In order to train, one must consider the pros and cons of live training versus simulation training. Simulation provides the means to replicate the situation of over 300 unguided missiles hiding a few guided missiles within that mass. One must scrutinize simulation as well because scripted training inhibits innovation. In the case of the Norwegian Navy, they have developed a competitive training environment that provides many benefits including increased discussion and innovation to improving understanding of swarm tactics and enhancing crew cooperation in a high-stress training environment.

Mr. Tompson then discussed the selection process for choosing Havok, namely: performance (especially visual), flexibility, speed of development, and support. Another tradeoff they needed to assess was whether to build a serious game or a federated system. Given the legacy systems of the Navy, the serious game did not prove as the best choice due to development cost and time. High fidelity 3D visualization and animation has proven to be the most important aspect of the training experience.

6.18 Alessandro Cignoni - Hybrid Validation Test-bench (HVT) for Autonomous Systems

Mr. Cignoni presented work of the M&S COE and requested the gaming experts in the room for input and comment. He began by defining the terms autonomous, autonomy, and autonomous systems. He noted different definitions exist within the community. His working group adopted the definition that highlighted self-governance and decision making independent of human interaction.

He then described the purpose and function of the test-bench project. It does not use HLA because the real life systems were using another mode of sharing real time communications. Robot Operation System (ROS) blends the real and virtual elements. The virtual world operated through a virtual world connector, which provided the data driven DDS message into a 3D model. Figure 5 presents the details of this connector. The tool used was a NADS product.

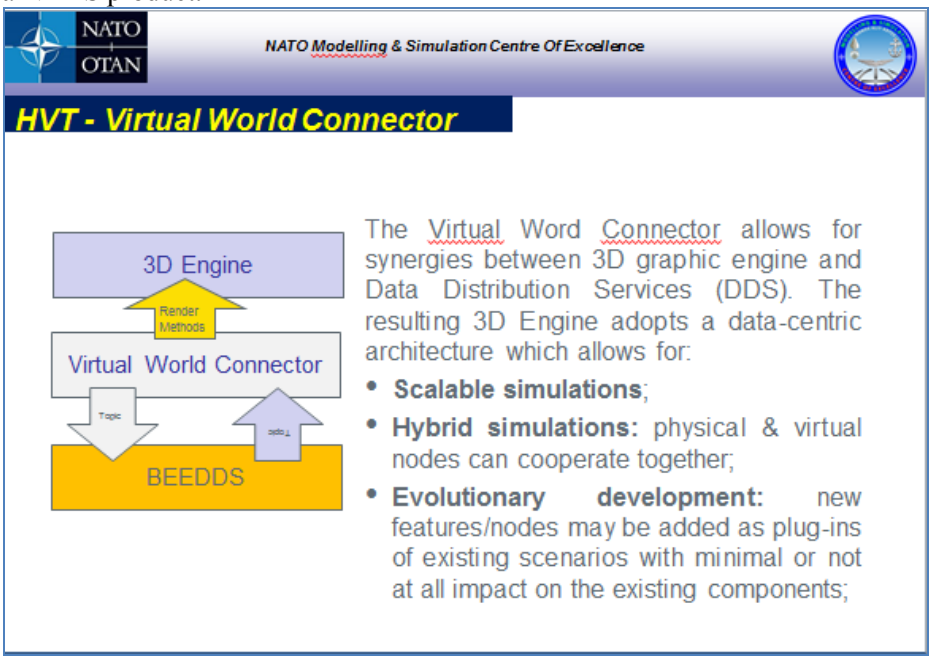


Figure 5: Virtual World Connector. A key element of the HVT is connecting architectures.

A key consideration is the use of simulation for interoperability. The Afghan Mission Network has stressed the need for effective coalition forces interoperability. Modelling and Simulation is a powerful tool to verify interoperability and to reduce costs of exercises. Mr. Cignoni also posed an interesting statement, "Games generally have many limitations for operations training." The thought behind this was addressing the question, "How do we train high level orders?" An upcoming conference (M&S for Autonomous Systems Workshop) will occur in May 2014 to address some of the concerns about interoperability and to consider the connections between game play and simulation.

6.19 Claudio Taraschi - Artificial Intelligence Software for Expert Knowledge Capture

Mr. Taraschi briefly described TESS-COM and their role in developing products for various LVC needs. He then described a software company (called Discovery Machine Inc.) initiated from the U.S. DoD/DARPA. It is an artificial intelligence software company focused on knowledge capture of world's top SMEs and enhancing training simulation by providing understandable software for instructor use. The approach is manifest in systems like JSAF and VBS2.

The DM Knowledge Service Modeler allows SMEs an ability to capture and encode knowledge in order to display and share it. Activity occurs automatically through a knowledge model and object-oriented programming. The basic strategy is taking the tasks, methods, and procedures and decomposing them into decision trees. Figure 6 shows the interfaces for defining characters.

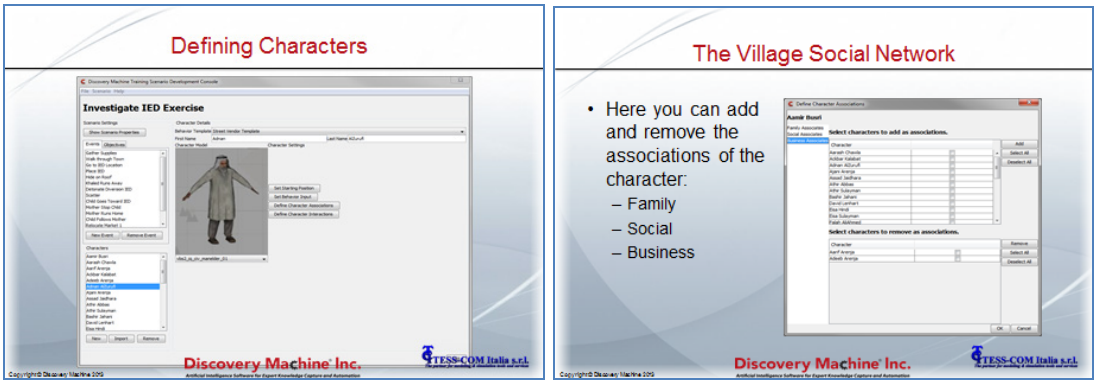


Figure 6. Defining Characteristics. Examples of screenshots.

One use case discussed was the maritime console done by the U.S. Navy. The problem was the need to have aviators train against realistic enemy submarines of several types. The solution focused on playing out this situation and capturing expert knowledge as opposed to designing software. Mr. Taraschi demonstrated the use of Discovery Machine inside a JSAF example.

Discovery Machine also has a console that can interact with VBS2 characters (like culture, skills, etc.) and the character behaves described by console inputs. It is extendable to land platforms, sea platforms, and air vehicles.

6.20 Lab Tours - Centre for Maritime Research & Experimentation (NATO CMRE) and MBDA

Friday October 11, 2013

6.21 Recap of Day 2

Mr. Wayne Buck led a short discussion on the presentations from Thursday. Some points that emerged:

- How might M&S support the discussion on the Human Internet presentation?
- It was interesting to see Gartner forecasts showing gamification lies at the "peak of heightened expectation" within their established framework
- Use cases and the lessons learned from yesterday were very good and he would like to see more of these in future events

6.22 Karel van den Bosch - Virtual Pilot: Agent-Based Simulation for Effective Training

Mr. van den Bosch presented a use case of an autonomous agent based pilot. He provided a brief overview of his organization, TNO, whose focus is to apply science to basic research and today's problems.

His problem statement noted the military requires more agent based training. It is important to collect the right people as a team at the same time and place under the guidance of capable experts using the right tools. These tools exist in training simulations, primarily as autonomous training in agent based modeling.

He presented a use case via video (it is available on You Tube using term "Virtual Pilot Netherlands"). Numerous challenges exist under current methods in training helicopter directing officers. The training audience is the Helicopter Directing Officer. A staff member serves as a role player and an instructor to oversee. Issues they must manage:

- Pilot availability is scarce
- Training requires two people
- There is no way to help standardize the language skills

Key to the solution is a speech recognition engine. This allows for elimination of the need for the staff pilot. Mr. van den Bosch noted an engine must provide a total view of required expertise:

- Didactical – learn from experience practicing strict procedures and clear speech; instructor must be able to maintain control and allow for post training analysis. Many examples of the procedures exist, but there any so many that they can often interfere. This requires an effective method of modeling
- Modeling – using BDI to model behavior (beliefs, desires, and intentions); the model uses XML to cue steps in the model based on the trainees speech
- Speech technology – language is a difficult element to master; work has been accomplished to improve speech recognition (phonemic models, language models for grammar, and lexicon); must model a lot of variances in the speech model
- Teaching methods – this depends on the acceptance of the new technology over the next year as a delivered product is provided to the school

In closing, he presented another example of a project using intelligent agents. It generates humanlike behavior and is understandable to people. It must be consistent with human information processing characteristics (cognitive modeling). Finally, agents generate behavior that is appropriate for its purpose (e.g., training). For example, individual training of team tasks executed using agents for on-board firefighting training. One trainee is able to get team training by effectively using agents to substitute the remainder of the team.

Overall, TNO is investigating agents in four categories:

- Virtual team mate: for individual training of team task
- Companion agent: acts as buddy of trainer to elicit reflection
- Intelligent opponent: provides realistic
- Tutoring agent: diagnose gaps in knowledge and skills and intervenes as necessary

Someone asked Mr. van den Bosch if they use the speech recognition program provided by Stanford Natural Language open source tools? He indicated TNO is using Nuance Loquendo for speech recognition. To deal with background and ambient noise, they use directional microphones. These appear to take care of this sufficiently.

Another question arose about how they deal with situational matters. Mr. van den Bosch stated the model checks if the Helicopter Directing Officer (HDO) is abiding by all procedures. An example is that helicopters must remain two miles from oil platforms. If the HDO does not keep the helicopter in the right profile then the model reacts accordingly. He concluded by noting system assessment by experimentation is planned as part of the next deliverable in January 2014.

6.23 Fabrizio Baiardi - Haruspex: A Tool Running a Fully Automatic Assessment of ICT Risk

Mr. Baiardi discussed the tool Haruspex. It is a tool to help simulate cyber-attacks for training:

- Build a model of your scenario (using Monte Carlo simulation)
- Run a penetration test on this model
- Tell you…
    - The defects of your infrastructure
    - The attacks that can be implemented against it
    - The probability that each attack is successful
    - The defects to remove to defeat your threats

Figure 7 provides a sample of the number and type of defects the Haruspex tool has been able to detect over the last decade.

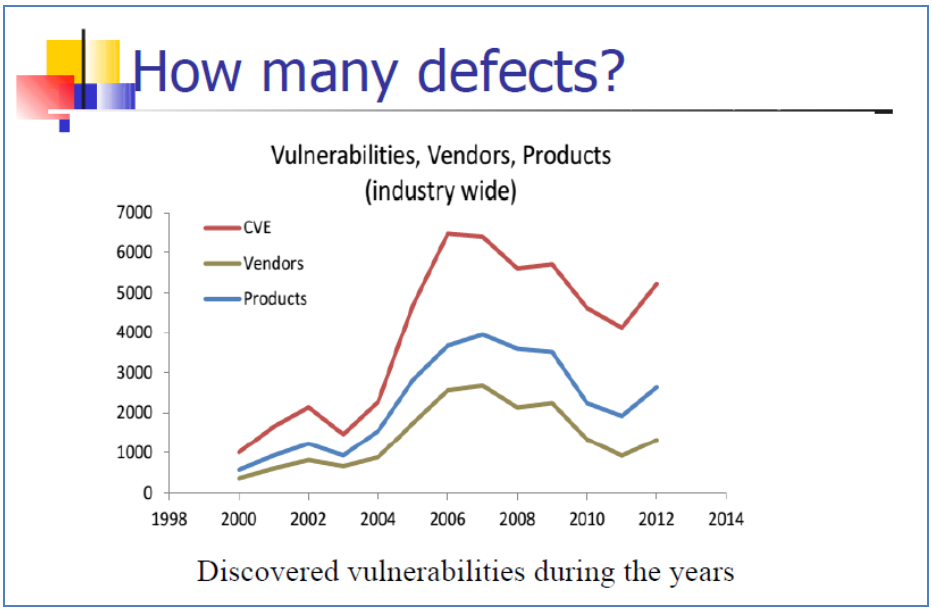
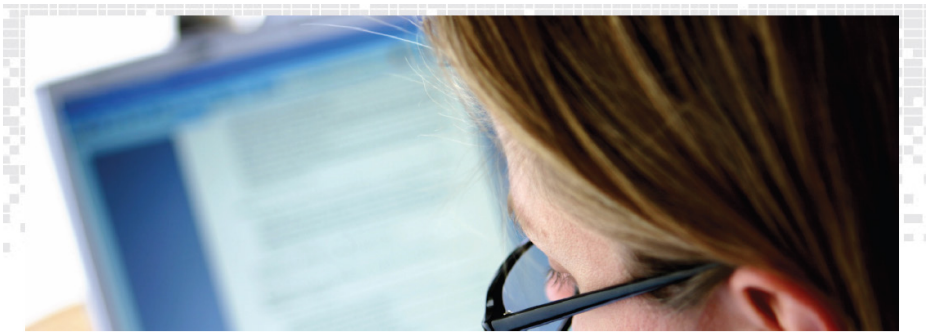


Figure 7: Characterizing cyberspace. Number of defects found using Haruspex since 2000.

This allows users to implement countermeasures in the infrastructure and determine how well they work to mitigate risk. This tool executes in a couple of hours using a highly parallel processing machines to build the model and run a Monte Carlo penetration test to discover vulnerabilities. Currently, his team is conducting case studies. They will analyze various infrastructures and describe results.

6.24 Stu Armstrong - Cyber's Achilles Heel: The Human Operator

Mr. Armstrong presented a short paper on the inside threat as it relates to education. The presentation began with discussion of EVE online – a persistent online game with as many as 350,000 online players in one world. The players – not the computer – introduce all content and conflict. The game has led to interesting lessons about human behavior. He noted two online crimes (not real crimes as they are all right within the game world) but included a Ponzi scheme and an embezzlement of a large online EVE corporation.



"The most vulnerable element of any network is the human operator, through malicious intent, negligent error or external manipulation – all of which can prove financially fatal to an organisation."

Figure 8: Vulnerability. The human operator remains the greatest threat in cyberspace.

These examples parallel two examples in the real world that had great impact on society, and neither had to do with technology. Rather, they occurred because of employee actions (or inactions). Mr. Armstrong punctuated this point with the description in Figure 8 noting the human operator as the most vulnerable element. He pointed out the best offense is overpowering defence. As a hacker noted, "you don't hack the system you hack the people." The interest for future consideration is balancing information access with information protection.

6.25 Paolo Proietti - MIMOS Celebrates its First Decade

MIMOS is an organization with a strong web presence to help educate groups about what is going on within Italian M&S. Figure 9 provides a screen shot of the portal at www.mimos.it

Figure 9: MIMOS Portal. A screen shot representation of the portal designed to give a great access of work going on within the M&S community.

Over the last ten years, they have held a number of multi-day and single-day conferences. In 2013, the MIMOS focus turned to more of an international perspective. Future plans (2014 and beyond) include:

- Support to ITEC
- Serious games in education
- Events such as MASAS 2014 and I2M 2014
- Industries such as automotive, food & beverage, logistics, medicine, virtual cultural history, and Sim & Sea

International focus will continue as demonstrated by work with Simulation Australia, Liophant, ETSA, ITSA, ADIS, M&SNet, and MISS.

6.26 Anders Frank - A Lecture on our Naval Warfare Game

Mr. Frank spoke on education and wargaming as a means to learn naval warfare. He provided a brief overview of the meaning of wargaming, highlighting simulation and people making decisions in response to players representing opposing sides. The Swedish Armed Forces has a wargame research program focusing on classroom exercises consisting of wargaming having low transaction costs in order to do more on a smaller scale. This is possible by identifying key aspects from learning objectives – games with low fidelity (good enough), without sacrificing learning.

They focus on three functions to make wargaming viable:

- Research: the key question is, "What can be learned from wargaming?" The answer is that it depends. They have taken a different focus: is it the game, the gamer, or gaming? This leads to many elements as well as fields like game based learning, gaming studies, and behavior psychology
- Development: the key question is whether to "develop games or modify existing regardless of medium or format in order to fit the pedagogical context?" Purpose dictates game arrangement that gives results. The game was summarized as preparation, the game itself (a small part of the greater context), and reflection/debriefing. Three examples of games used at his organization:
    - Simple Surface Warfare
    - Asymmetric Warfare Boardgame
    - Master of Air Operations
- Practice: this provides game support to courses as game controllers and instruction. It is a terrific way to get output, insights and basically is the *unit of analysis* for research

Mr. Anders provided more on the Simple Surface Warfare game by means of example. It is a low fidelity, simple model game. Two assumptions commonly exist in the learning community:

- higher fidelity equates to better training
- training is good if a subject matter expert thinks it is good

There is little evidence that support those assumptions. Other aspects of training are more important than fidelity: guided practice, feedback, performance measurement, and scenario construction. Low fidelity games provide many benefits:

- easy to learn
- few number of operators required
- low development costs…saves time and money

This must all ensure it does not come at the expense of gaming:

- Dynamic environment against a live, thinking opponent
- Competitive environment
- Follows the logic of gaming, hence learning
- Design the activity based on the key learning objectives

He presented the overall flow of the training course showing Week 6 of the 8-week course. The game is five days including planning, execution then reflection. An observation is that when the students play the game again, evidence of learning emerges. The week concludes with feedback. They have used the game for three years and at many different levels of student from cadet to senior officers.

6.27 Fabio Camponeshchi - Platform Defend Game

Mr. Camponeshchi discussed the use of the serious game called Platform Defend. It relies on the concept on gamification in order to use games to engage users in solving problems. Serious games are not simulations alone, but a have a look and feel of a game with a chance to win. Within the commercial market, documentation shows it enhances learning and retention.

The game Platform Defend is in a state of demonstration. It revolves around a situation to defend a platform inside of host-nation territorial water that is close to an important undersurface archeological site. The mission is to assure platform security by destroying any hostile targets without harming friendly targets and wildlife. The threats include small boats, small aircraft, divers, and small undersea vehicles. Sensors include camera, passive sonar, radar, and unmanned surveillance vehicle camera. Weapons include reactive sonar, USVC warhead missiles, and heavy weapons.

Rules of engagement exist in simple logic tables. They go beyond common sense in that they are military orders. They are written at the commander level – focusing on understanding and verifying the situation in order to give appropriate orders.

The objective of the project is to demonstrate how gamification and application of some serious game principles can help to improve the user ROE knowledge. Game flow revolves around target detection, identification, and application of ROE. Other targets appear until the last target appears, provided the platform is not destroyed before then. The game ends with feedback and an evaluation.

Mr. Camponeshchi presented a view of the game interface. They noted it is not much different from games available on the internet or through console game providers. The user interface includes a sight picture, the ability to conduct actions, and review history of game play. Most important is the evaluation, which includes the score, how many ROE applied correctly or incorrectly, as well as summary statistics of the activity during the game (such as type of targets destroyed.) This information enables an after action review to discuss how well the players adhered to the ROE.

In conclusion, they are using Serious Gaming. There is reliance on other elements such as the immersive environment, game features, ad hoc scenarios, and skill improvement. Development costs are very low – approximately 4-weeks of work and few thousands of dollars. Presenters provided a brief demonstration of the game.

6.28 John Milam - Interdependencies within the Maritime Transportation Sector

Mr. Milam discussed the use of serious games to promote an understanding of the analytic aspects of port security and consequence management of the critical infrastructure. The work is for the Department of Homeland Security and is a process of creating small exercises for small to large teams. The driver in this project is to enhance profitability of the port operations. There is a large interdependence between the ports

and many other economic domains like health, tourism, energy, and the like. So in the in the event of a natural emergency, what should the port operators consider and act upon?

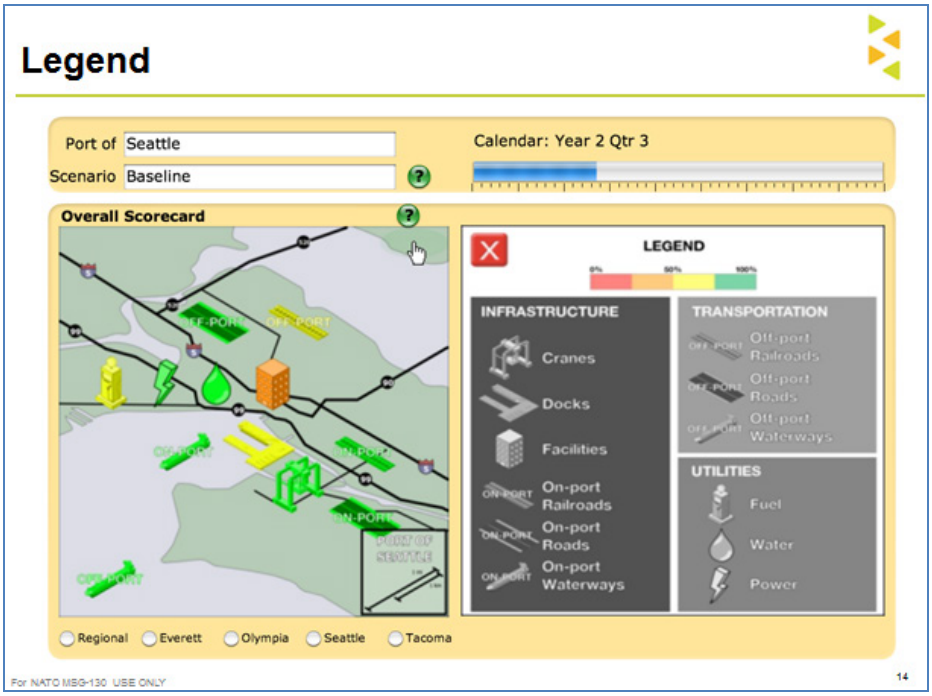


Figure 10: Seattle Port. Visualization of the model data for one of the ports being studied.

Figure 10 shows one of the many screen shots provided to describe the work. The tools help them data (static and interviews with domain experts) to create the algorithms that simulate the flow of assets and stocks. Impacts depend on where the issue strikes. Assets include the workforce, cranes, berthing spaces, road, buildings, marina, the repair team, and labor costs. All these building blocks connect to create a generic model and customized for the four ports of interest. A fifth model than brings the ports together into a holistic view.

One lesson learned is that trying to force the "calculus" on the port operators does not work. Rather, the user experience must be one that is based on mappings and very simple color-coded, pictures. Dashboards are used communicate information on resources and financial implications. One important aspect is capturing the constraints because constraints help force decisions – often, hard decisions. Outputs include dashboards that are similar in look and feel to those used by the current operators to extend the metaphor. It also includes rollups of the data in order to allow management by objective – drilling down into details of interest.

The overlying interest is that in the case of disasters ranging from Kobe, Japan to Haiti, areas take a long time to recover if they recover at all. This is because the systems have a way of rerouting flow to operable facilities. Therefore, by showing operators with the impact of decisions they can consider the long-term effects of actions today on economies tomorrow.

6.29 Davide Corsanini and Fabrizio Sciarra - Weapons Training Using "Virtual Reality": A Hardware-in-the-loop Approach

Messrs. Corsanini and Sciarra talked about the training of special machine guns using virtual reality. The Hitrole Training System uses an approach to training that combines real weapon systems and a virtual reality environment in which both interact and influence the other. Advantages include:

- Safety
- Economical (no ammunition or target loss)
- Can prepare more complex scenarios than available in the real world
- Use the same weapon with the same logic
- Training can be performed on the ship…not required to use it in a classroom

A case study described integration of the real weapon with the SIMSUITE. The Hitrole is a small caliber machine gun that be operated manually or remotely. SIMSUITE is an integrated 3D viewer and simulation development system. It has been adapted to include required optical system characteristics, represent light, sea, and weather conditions; represent effects like smoke, explosions, and splash; and simulate and sustain the fire rate of 600 rpm.

The architecture explained how the simulation infuses an optical representation of a threat into the actual system placed in training mode. The weapon reacts as if it were a real target because of the hardware in the loop approach.

Mission planning includes a 2D representation of the world and use different platforms and settings (for both threats and friendlies). It uses standard iconography to build the scenario. The operator (trainer) can add targets and waypoints. All data lies in the SQL DB including details about the mission, entities, and platforms. A short demonstration depicted the user interface. Features in the existing 3D engine account for light and weather conditions. The 3D image transmits to the trainees' workstations.

Integration, in this case, includes:

- What happens when gunner moves the weapon
- What happens when gunner shoots

The SIMSUITE logs all the events for each projectile and target. Leaders can review results to assess gunner performance. Previous training sessions are accessible for comparative analysis. The future work includes integration of the weapon tracking where the servos will actually move during training as well as terrestrial weapons training.

6.30 Wrap Up by Mr. Stu Armstrong and Mr. Wayne Buck

Mr. Wayne Buck began the wrap-up. He provided a summary about predications made over the past years. Five years ago (2008) the predictions included:

- Highly realistic scenarios are affordable for others than just governments/soldiers (attained)
- Training games are becoming more realistic than those for entertainment (attained - although entertainment industry has continued to improve)
- New types of training scenarios are driving new type of training technologies (attained)
- Joint missions are driving interoperable solutions (attained)
    - This garnered much discussion about sharing among companies and organisations
    - Generally seen as a prediction that has been attained but more questions have emerged over the last five years
- Greater emphasis on end-user experience (attained)

This helps to demonstrate that we – collectively – have grown towards these. A key objective of this series of workshops has been to bring together the right people from government, academia, and industry to progress the field.

Mr. Stu Armstrong noted the technology has come along quite well with some interesting technology as well as some good use cases and analysis. He still believes it is very early data and there is the risk of focusing too much on a subset of the possible solutions. It would be unfortunate to have a few successful use cases and then extending them beyond their utility without exploring other approaches to different use cases.

Dr. Augustino Bruzzone noted the value of feedback and value of the work underway. At the beginning, the concern was that the technology was just games and it could induce negative training. Evidence shows this is not the case. However, now the questions focus on the value in terms of cost, time, and enhanced learning. Getting a better understanding on the return on investment would be a wise area to invest our time.

Mr. Wayne Buck gave a special thanks to the participants, the hosts (Dr. Bruzzone, and Alessandro Tesei, and the presenters. He then bid everyone adieu until the next time.

7. CONCLUSION AND RECOMMENDATIONS

7.1 Conclusion

Participants and workshop organizers assessed this session of MSG-130 as a complete success. The workshop met its stated goals:

- Through demonstration, experimentation, discussion and debate, attendees will acquire knowledge and experience in the possible topic areas.
- Technical and application briefings and demonstrations on selected commercial technology areas will help the attendees better understand the issues so that they may more properly aid in the development of the strategy for the NATO and the Nations to exploit these technologies.
- Participants will develop a shared understanding of the issues and opportunities.
- Meeting proceedings will capture the presentations and provide recommendations for NATO and the Nations.

NATO partner nations currently use commercial games and technologies. The workshop participants concluded that a need to continue pursuing these technologies is essential, and additional effort could focus on validation of technologies, education of users, and the evaluation of existing acquisition and procurement guidelines.

Finally, NATO and ACT enjoy an organisational infrastructure and innovative partners to facilitate these types of workshops in the future. They should continue to do so.

7.2 Recommendations

Technology has come along very well but it is more than just technology. There are cultural aspects of gaming that should be recognized and studied to serve trainees. Overall, the process is still early for Serious Games and if a focus remains solely on technology, there is a risk of becoming shortsighted. Meanwhile, feedback is a very valuable asset in this current time of Serous Games. Whereas early concerns about Serious Games being harmful has been put to rest, the next line of questioning focuses on the cost and time of games for learning. The group felt it was wise to understand the return on investment and would welcome inputs at future workshops on this aspect.

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