Defence Research and Development Canada
Recherche et développement pour la défense Canada

DEFENCE R&D DÉFENSE

Synthetic Environments at the Enterprise Level:

Overview of a Government Canada (Goc), Academia and Industry Distributed Synthetic Environment Initiative

A.L. Vallerand, B. Kim, R. Youssef, P. Hubbard, D. Skinner, B. Murray, S. Poursina, C.M. Herdman, M. Gamble, L. Hagen, D. Bleichman, D. Kurts R. Kruk, R. Lavoie and K.G. Gladstone

Defence R&D Canada – Ottawa
TECHNICAL MEMORANDUM
DRDC Ottawa TM 2005-130
April 2005

Canada

SYNTHETIC ENVIRONMENTS AT THE ENTERPRISE LEVEL:

OVERVIEW OF A GOVERNMENT OF CANADA (GOC), ACADEMIA AND INDUSTRY DISTRIBUTED SYNTHETIC ENVIRONMENT INITIATIVE

A.L. Vallerand, B. Kim, R. Youssef, P. Hubbard, D. Skinner, B. Murray, S. Poursina
Defence R&D Canada Ottawa, ON

C.M. Herdman, M. Gamble, L. Hagen, D. Bleichman,
Carleton University, Ottawa ON

D. Kurts, R. Kruk, R. Lavoie, K.G. Gladstone.

CAE Inc., Montreal, QC

Defence R&D Canada – Ottawa

Technical Memorandum

DRDC Ottawa TM 2005-130

APRIL 2005

Abstract

A new partnership between the Government of Canada (GOC), Industry and Academia is working to help Canada become a world leader in Modeling and Simulation (M&S). The goal is to take SMARRT technologies - Simulation and Modeling for Acquisition, Requirements, Rehearsal and Training - and apply them to the development and improvement of Canadian Forces (CF) military systems and capabilities, as well as a vast host of civilian applications. To this end, the initial partners conceived the October 2004 UAV-NTS SE Interoperability Experiment, which links DRDC Ottawa's Uninhabited Air Vehicle Research Test Bed (UAV RTB) to a Carleton University Networked Tactical Simulator (NTS) modified with CAE Inc. synthetic environment (SE) assets including computer-generated forces. The experiment took place via a non-dedicated unclassified, though VPN-encrypted network over a period of several days. Prospective GOC, Academia and Industry partners, as well as foreign military personnel, attended these sessions. The goal was to show how M&S technologies can be used and made relatively easy at the national/enterprise level, and how lessons learned and technical best practices point to a bright future for distributed synthetic environment applications in Canada's Department of National Defence, as well as for DND's public security partners. This joint S&T report documents an overview of the M&S/SE standards and tools related to JSMARTS, the data stemming from aircrew being subjected to the experimental protocol as well as the technical data describing the connectivity and interoperability amongst participants. Finally, this overview is complimented by a short video clip (available on the CD only).

Résumé

Un nouveau partenariat entre le gouvernement du Canada (GdC), les Industries et les Universités entend contribuer à faire du Canada un chef de file mondial en matière de modélisation et de simulation (M&S). Le but consiste à mettre à contribution les technologies SMARRT (Simulation and Modelling for Acquisition, Requirements Rehearsal and Training) pour élaborer et améliorer les systèmes et capacités militaires des Forces canadiennes (FC) de même qu'une vaste gamme d'applications civiles. À cette fin, les partenaires initiaux précités ont présenté l'expérience d'interopérabilité VAT - STR ES d'octobre 2004, qui mettra en jeu d'un côté le Banc d'essai pour la recherche sur les véhicules aériens télépilotés (BER VAT) de RDDC Ottawa, et de l'autre côté, à l'Université Carleton, un simulateur tactique en réseau (STR) modifié au moyen des éléments d'environnement synthétique (ES) et d'un progiciel militaire généré par ordinateur de CAE Inc. Échelonnée sur trois jours, l'expérience a fait appel à un réseau non dédié et non classifié, quoique protégé par RVP (Réseau Privé Virtuel). Des partenaires éventuels du GdC, du milieu universitaire et de l'industrie, ainsi que du personnel militaire étranger, ont assisté aux sessions. Le but de l'expérience était de montrer comment les technologies de M&S peuvent être utilisées au niveau des entreprises et de la nation, et comment les leçons apprises et les meilleures pratiques techniques laissent entrevoir un avenir brillant pour les applications des environnements synthétiques distribués aussi bien au ministère de la Défense nationale du Canada que chez ses partenaires dans le domaine de la sécurité publique. Ce rapport S&T conjoints documente les normes et les outils M&S/ES liés à JSMARTS, les données expérimentales fournies par les pilotes qui exécuteront le protocole de l'expérience, ainsi que les données techniques décrivant les conditions dans lesquelles la connectivité et l'interopérabilité seront obtenues entre les participants. Finalement, ce rapport est complété par un court vidéoclip (disponible sur le CD seulement).

Executive summary

SMARRT (Simulation and Modeling for Acquisition, Requirements, Rehearsal and Training) has been identified as a crucial enabling technology that fulfils Canadian Forces (CF) objectives related to development and improvement of military systems and capabilities. Today, the Government of Canada (GOC) and many nations worldwide have fully embraced SMARRT as part of their daily business model from Concept Development & Experimentation to Disposal. However, few countries have conceived an overarching vision of SMARRT at the Enterprise/National level or "Joint SMARTS" across Government, Industry and Academia, similar to that of the Department of National Defense of Canada (DND). Endorsed at a National workshop in June 2004, the JSMARTS vision was conceived to ensure that the development and use of M&S knowledge, International M&S Standards, M&S know-how and Interoperability of M&S exists not only in DND but also across the GOC, Academia and Industry.

Initially, the October 2004 Interoperability Experiment included initially the linking of the Uninhabited Air Vehicle Research Test Bed (UAV RTB), at DRDC Ottawa, with a modified Networked Tactical Simulator (NTS) with several CAE Inc constructive assets and Computer-Generated Forces, at Carleton University, via a non-dedicated unclassified, though VPN-encrypted network. The initiative has been termed *the "UAV-NTS SE Experiment"*. This joint S&T report is documenting the M&S/SE standards and tools, the experimental data from aircrew subjected to the experimental protocol as well as the technical data describing the successful connectivity and the interoperability amongst participants.

The experiment occurred over a period of several days, allowing time for demonstration to Government, Academia, Industry and foreign military personnel. The objective of the exercise is to give insight into the technical best practices, lessons learned, preliminary results of the experiment, as well as the potential for future distributed synthetic environment applications in DND, in conjunction with Public Security partners, supporting diverse tools, thus effectively embracing the concepts of SMARRT and "JSMARTS" i.e.: teaming to employ M&S/SE at the Enterprise/National level, from Concept Development to Disposal of any system or any capability, with any GOC, Industry or Academia participant. A short videoclip compliments dynamically the present report (available on the CD only).

Vallerand, A.L., B. Kim, R. Youssef, P. Hubbard, D. Skinner, B. Murray, S. Poursina, C.M. Herdman, M. Gamble, L. Hagen, D. Bleichman, D. Kurts, R. Kruk, R. Lavoie and K.G. Gladstone. 2005. Synthetic environments at the Enterprise level: Overview of a Government of Canada (GoC), Academia and Industry distributed synthetic environment initiative. DRDC Ottawa TM 2005-130. Defence R&D Canada – Ottawa.

Sommaire

SMARRT (Simulation and Modelling for Acquisition, Requirements Rehearsal and Training) a été identifié comme technologie permettante cruciale qui accomplit des objectifs des Forces Canadienness (FC) liés au développement et à l'amélioration des systèmes et des capabilités militaires. Aujourd'hui, le gouvernement du Canada (GdC) et beaucoup de nations dans le monde entier ont entièrement embrassé SMARRT en tant qu'élément de leur modèle quotidien d'affaires, du développement initial de concept et d'expérimentation à la disposition finale. Cependant, peu de pays ont conçu une vision globale de SMARRT au niveau de l'Enterprise/National ou au "Joint SMARRTS" à travers le gouvernement, l'industrie et le milieu universitaire, semblables à celui du département de la défense nationale du Canada (MDN). Approuvé à un atelier national en juin 2004, la vision de JSMARTS a été conçue pour s'assurer que le développement et l'utilisation de la connaissance de M&S, des normes internationales de M&S, du savoir-faire de M&S et de l'interopérabilité de M&S existe non seulement dans MDN mais également à travers le GdC, le milieu universitaire et l'industrie.

Au commencement, l'expérience d'interopérabilité d'octobre 2004 a inclus l'enchaînement du banc d'essai pour la recherche sur les véhicules aériens télépilotés, à RDDC Ottawa, avec un simulateur tactique géré en réseau modifié (NTS) avec plusieurs simulations constructives et progiciel militaire généré par ordinateur de CAE Inc, à l'université de Carleton, par l'intermédiaire d'un réseau non classifié, non spécialisé quoique protégé par RVP (Réseau Privé Virtuel). L'initiative s'est nommée "l'expérience d'environnement synthétique (ES) VAT - STR ES". Ce rapport S&T documente les normes de M&S/ES, les outils, les données expérimentales de l'équipage aérien soumis au protocole expérimental aussi bien que les données techniques décrivant la connectivité réussie et l'interopérabilité parmi les participants.

L'expérience s'est produite pendant plusieurs jours, permettant une démonstration au gouvernement, le milieu universitaire, l'industrie et le personnel militaire étranger. L'objectif de l'exercice est de donner in aperçu des meilleures pratiques techniques, des leçons apprises, des résultats préliminaires de l'expérience, ainsi que le potentiel pour des futures applications d'environnement synthétique répartie dans le MDN, en même temps que chez les partenaires de sécurité publique, supportant divers outils, de ce fait embrassant efficacement les concepts de SMARRT et de "JSMARTS" c.-à-d.: se regrouper pour utiliser M&S/SE au niveau de l'Enterprise/National, du développement initial de concept jusqu'à à la disposition de tout système ou toutes capabilités, avec tout participant de GdC, d'industrie ou de milieu universitaire. Un videoclip court complimente dynamiquement le présent rapport (disponible sur le CD seulement).

Vallerand, A.L., B. Kim, R. Youssef, P. Hubbard, D. Skinner, B. Murray, S. Poursina, C.M. Herdman, M. Gamble, L. Hagen, D. Bleichman, D. Kurts, R. Kruk, R. Lavoie and K.G. Gladstone. 2005. Synthetic environments at the Enterprise level: Overview of a Government of Canada (GoC), Academia and Industry distributed synthetic environment initiative DRDC Ottawa TM 2005-130. R & D pour la défense Canada – Ottawa

Table of contents

1. Background 1

2. Experiment Overview 3

3. Experimental Objectives 4

4. System Design 6

5. Key Results 8

6. Lessons Learned 9

7. Conclusion 10

This page intentionally left blank.

List of figures

Figure 1 – JSMARTS Concept 1

Figure 2 – Experimental Human Factors Metrics 5

Figure 3 – UAV RTB Design 6

Figure 4 – UAV-NTS SE Experiment System Architecture 7

ACKNOWLEDGEMENTS

This Technical Memorandum is the product of three Organizations and their individual representatives who were and are still passionate about M&S/SE. These individuals conceived this unique collaborative initiative about how to “make M&S easy enough” so that Government of Canada, Industry and Academia simulationists could execute a distributed simulation across a wide area network with such organizations, within an unheard of four to six weeks! This is the overview summary of that superb and bold initiative. The immense success obtained can only be attributed to ALL staffs in each of the initial Organizations (DRDC Ottawa, Carleton University and CAE Inc) who pulled together in order to achieve this Canadian First ! A million thanks. The authors also want to thank Mr. Jean Beaudin, Head of Communications at DRDC Ottawa, for his unwavering support during V.I.P. days as well as for the fact sheets, press release, guidance and support to the film crew, translations, etc. A million thanks to each and everyone who believed, participated and finally shared with all of us the same passion for M&S/SE in Canada.

1. Background

The use of modeling and simulation (M&S) as an effective tool for validating concepts or software is in of itself not something new. It has been around in industry, academia and government for years, if not decades. However, the use of M&S as an integral part of the entire weapon system lifecycle tool kit is something more recent. It is now gaining widespread acceptance as a means of not only ensuring that the weapons systems that are being procured actually meet the intent of the stated requirements, it is also valuable for validating those very requirements. Yet despite this acknowledgement that M&S has a valuable role to play in system procurement, widespread implementation still remains an elusive goal. Recently, three crucial players in the M&S arena, government, academia and industry in Canada decided to take on this challenge. Together they built a distributed M&S system and conducted an operational experiment involving simulated land aviation and UAV elements within a period of little more than four weeks from inception to completion.

M&S has gained a new level of pre-eminence throughout most national procurement agencies: Canada is no exception. Simulation and Modeling for Acquisition, Requirements/Rehearsal, Training and Support (SMARRT) has been identified by the CEO of Defence R&D Canada (DRDC), Assistant Deputy Minister S&T, as a crucial enabling Technology, which fulfils Canadian Forces (CF) objectives related to the development and improvement of military systems and capabilities. Many nations have fully embraced “SMARRT” as part of their daily business model from Concept Development to Disposal.

Figure 1 – JSMARTS Concept

At a June 2004 National workshop (Ref. 1), the Canadian DND Assistant Deputy Minister (Mat) endorsed an overarching “Joint SMARTS” (JSMARTS; see Figure 1) vision whereby the development and use of M&S knowledge, international M&S standards and M&S interoperability exists not only in DND but across GOC, Academia and Industry. In accord with this vision, DRDC Ottawa, Carleton University and CAE Inc. conducted a JSMARTS interoperability experiment whereby the Uninhabited Air Vehicle Research Test Bed (UAV RTB) at DRDC Ottawa was linked with a CH146 Griffon Networked Tactical

Simulator (NTS) at Carleton University. A non-dedicated though encrypted unclassified network was used to connect the two facilities. CAE Inc. provided constructive assets to facilitate interoperability between the two sites and to advance the architecture and core capabilities of the NTS system at Carleton University. This JSMARTS initiative has been termed the **"UAV-NTS SE Experiment"**.

2. Experiment Overview

In the UAV-NTS SE Experiment, Canadian DND CH146 (Bell 412) aircrew flew the NTS through a series of simulated tactical missions. The link between the UAV RTB at DRDC and the NTS at Carleton University provided real-time simulation of different modes for streaming sensor information from a UAV to CH146 aircrew. The impact of the UAV sensor information on CH146 aircrew performance, situation awareness and workload was captured.

An important goal in this JSMARTS initiative was to establish a fully functional and stable distributed simulation environment within a period of 4 – 6 weeks, from initial conception to execution. This goal was achieved. In addition, interoperability between previously incompatible systems was accomplished, thereby demonstrating that legacy simulations and models can be integrated into future activities. The experiment occurred over a period of three days. The intention of this effort was to give insight into the technical best practices, lessons learned, preliminary results of this experiment, as well as the potential for future distributed synthetic environment applications in DND, in conjunction with Public Security partners, supporting diverse tools, thus effectively embracing the ADM (Mat)-initiated concept of “JSMARTS (Joint Simulation, Modeling for Material Acquisition, Requirements, Training and Support) or teaming to employ M&S/SE at the Enterprise/National level.

3. Experimental Objectives

There were core objectives at both the macro and micro level. At the macro level, the intent was to demonstrate the feasibility of creating an affordable and effective M&S capability that could show the utility of evaluating operational concepts before implementation. The macro objectives are described as follows:

- Investigate use of M&S within JSMARTS context, or M&S at the Enterprise level;
- Leverage previous M&S experiments, lessons learned;
- Rapid implementation and execution within 6 weeks of a Distributed Simulation capability to include network connectivity, establishment of a functional synthetic environment and development and set up of an experiment scenario, all within a High Level Architecture (HLA) **F**ederation **E**xecution and **DE**velopment **P**rocess (**FEDEP**) process;
- Investigate technical issues related to **F**ederation **O**bject **M**odel (**FOM**), **R**un **T**ime **I**nfrastructure (**RTI**), latencies, and bandwidth;
- Engage Government DND and Public Security communities in M&S discussions through presentation of results;
- Capitalize and augment interoperable M&S capabilities of Government, Academia and Industry; and
- Create a persistent ability to easily employ M&S in Government, Academia and Industry to jointly explore/analyze new Capabilities.

The micro level objectives were more operationally specific. The intent was to determine the workload and situational awareness implications of joint land aviation and UAV operations. To this end, these objectives were oriented towards a realistic operational scenario and focused on evaluating human performance in a Network Centric Warfare context. This was done by assessing the impact of the UAV sensor assets on the performance of CH146 Griffon aircrew using the following metrics related to situation awareness, workload and tactical performance (see Figure 2):

Figure 2 – Experimental Human Factors Metrics

The crews were assigned the task of planning and executing a tactical mission with the objective to locate, identify, and to neutralize enemy targets. The roles of the different assets were target detection by a MALE UAV, target identification by CH146 Griffon helicopter, and the execution of an artillery mission directed by the Griffon Mission Commander (MC) based on pre-determined Rules-of-Engagement (ROE). This mission was repeated by each crew under three different scenarios, after which they were given questionnaires addressing each of the above human factors variables.

- Scenario 1: Sole CH 146 Ops.
- Scenario 2: CH 146 and UAV Ops with third party communications link.
- Scenario 3: CH 146 and UAV Ops with direct UAV-CH146 data link in addition to a communications link.

4. System Design

The system design was based on two integral components: a UAV Research Test Bed (RTB) based at the Defence Research & Development Canada laboratory outside of Ottawa at Shirley's Bay and a CH 146 utility tactical helicopter medium fidelity networked tactical simulator (NTS) situated at Carleton University in the centre of Ottawa, Canada, a distance of approximately 40 km between the two. The UAV RTB was a simulated UAV that utilized the standard UAV CDL Inc software control interfaced to a synthetic environment powered by CAE STRIVE™ Synthetic Environment tools and the CAE Medallion S™, a COTS PC based visual system that provided the synthetic Out-The-Window (OTW, with an Electro-Optic sensor) and Forward Looking Infra-Red (FLIR) images. This hi-fidelity simulator is supported by DRDC Ottawa's persistent Simulation capability (Ref 2) that also supports a varied collection of COTS and GOTS tools as a collaborative Synthetic Environment (Ref 3).

Figure 3 – UAV RTB Design

The CH146 simulator consisted of a three channel COTS PC Medallion S™ based visual system integrated with CAE STRIVE™ synthetic environment and the simulation host software. Both systems were linked via the CANARIE network, an unclassified distributed, though VPN-encrypted network used nationally by Canadian academic institutions. Cisco

PIX™ firewalls were used at all sites since they allow user-friendly reconfiguration and they have the built-in VPN software that allows for the encrypted tunneling.

The various FOMs and RTIs in use by each system were made compatible via CAE's STRIVE-RTI Connect (GENESA), which is a next generation network interconnection system that provides multi-protocol network simulation data routing between simulation systems, as shown on Figure 4.

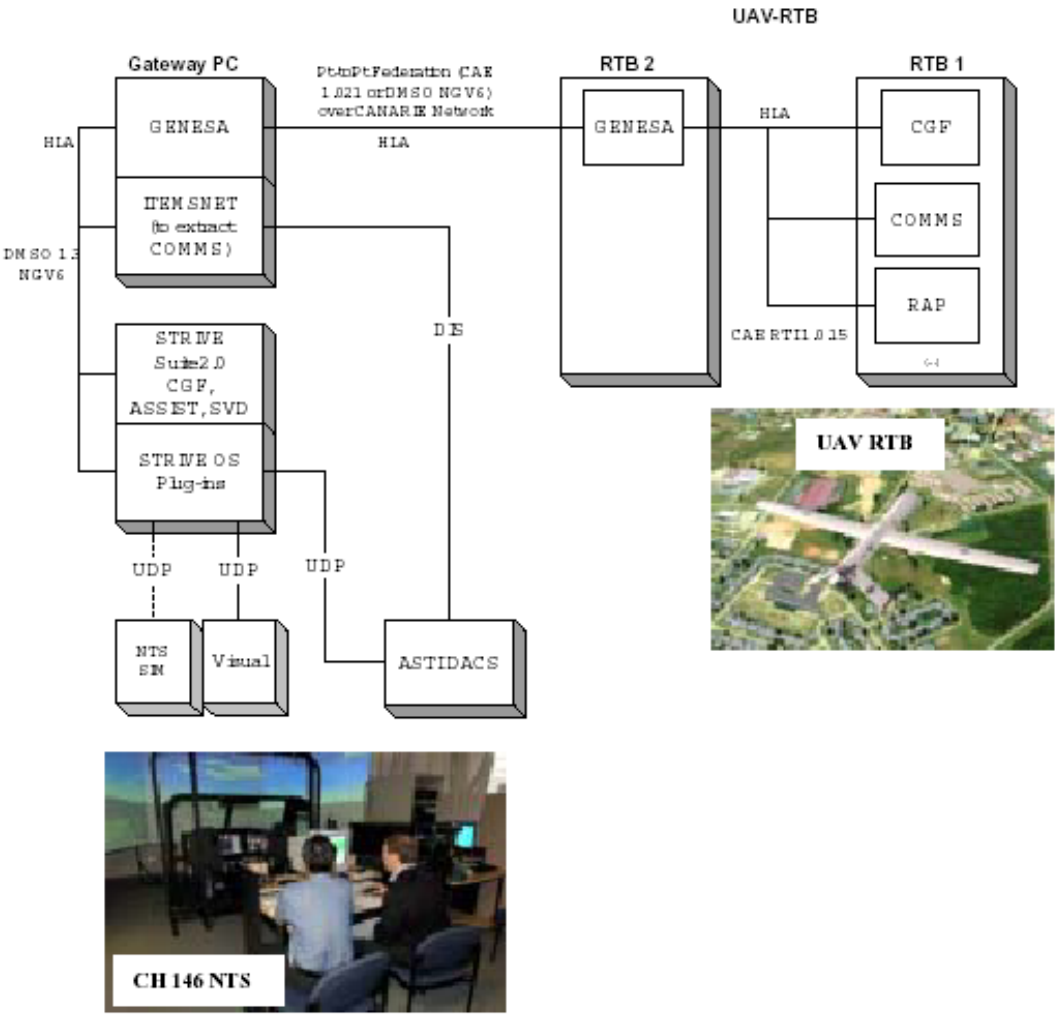

Figure 4 – UAV-NTS SE Experiment System Architecture

5. Key Results

Given the limited resources and time available to complete this experiment, the results were encouraging. From a technical perspective, the completion of the experiment showed that it was possible to conduct a distributed simulation experiment that was both affordable and effective within a HLA environment using different FOM and RTI. Furthermore, the Government of Canada (GOC), Academia and Industry team members were able to successfully use a non-dedicated unclassified network for Distributed Mission Operations (DMO). The obvious benefit was that it was a readily available network that could be used without lengthy security certifications, modification or additional cost. An unexpected challenge, though, was the circumnavigation of the various firewalls. A significant amount of effort was required to overcome the firewall limitations to allow the M&S systems and all HLA communications to function as desired.

From a human performance perspective, it became clear to the military operators involved that this distributed M&S capability was an excellent vehicle for assessing and validating new operational concepts that would not available in a stand-alone capability. In particular, the crew situational awareness was enhanced with access to the UAV asset albeit at a cost of increased workload (Ref. 4). In general, overall performance or the tactical effectiveness of the CH 146 crews could be enhanced when they access to the UAV information (in a Network- Centric Operations context), especially during high gain tasks.

6. Lessons Learned

One of the obvious benefits of conducting such an experiment is the derived lessons learned. There is no doubt that more could have been achieved had there been more time than the allocated six weeks. Regardless, this M&S initiative was a success. The following key lessons learned will contribute to more effective results in follow-on experiments.

- Experiment scenarios needed to be more dynamic to create an environment of higher and more realistic workload.
- The process for the setting of objectives for the data collection was not as robust as being ready to conduct the experiment itself. For the next phase, there would need to be more focus on the FEDEP, which gives an element of process flow to challenging initiative.
- It is important to define the tempo and content of scenario so that it is line with the objectives of the exercise. For example, define to what degree do you slow down the tempo of the exercise to account for the progress/performance of the crews or do you proceed ahead with the operational tempo regardless of crew performance.
- It was possible to put together an interoperable Federation in about 6 weeks and executed over non-dedicated unclassified network;
- Firewalls by their very nature are designed to prevent abnormal access to IT systems. Sufficient time and consideration needs to be given to this challenge if a Distributed Mission Operation s (DMO) experiment is to be successful.
- Aviation crew performance is enhanced through the use of another information asset such as an UAV, especially within a high threat and high gain environment, leading to increased tactical effectiveness with multi-UAV operations.
- Achievement of HLA distributed simulation with GOC, Academia and Industry partners created a synergistic critical mass of expertise that contributed to this cost effective and successful M&S initiative.

7. Conclusion

Modeling and simulation are now used in a pervasive fashion in the daily activities of the DND (Ref. 5). Since M&S has now become part of our business model in some degree, there is no doubt the benefit of M&S as an assessment and validation tool has been appreciated and thus M&S are clearly established within the procurement community. The outcome of this experiment has shown that the creation of this agile distributed M&S capability does not need to be an extensive venture that remains the purview of well-equipped and financed institutions: in some cases, like the present one, M&S/SE can be easy enough or "fit for the purpose", and almost at no extra costs other than the cost of each lab in acquiring their existing M&S assets in the first place. The present report has documented that a specific M&S capability can be custom-designed to meet the needs of the user at a reasonable cost and within an acceptable time frame. More importantly, this initiative has demonstrated at least two key concepts: 1) what has been achieved could have never been accomplished alone, and 2) that by combining the relative strengths of government, academia and industry, novel and effective approaches to defining viable "fit-for-the-purpose" solutions to meet the M&S challenge can be found.

References

1. JSMARTS Workshop. ADM (Mat) DMASP-led workshop on Joint Simulation and Modeling for Acquisition Requirements Training and Support (JSMARTS). June 2004, Ottawa, ON

2. Thompson, M. Joint Simulation Network (JSimNet) and Modeling & Simulation Resources Repository Network (MSRRNet) Descriptions and Roles, and their Interactions, DRDC Ottawa Contractor Report, 1 October 2002

3. Brown, R.G., M. Thompson, and C. Brochu. Software to Support Modeling Simulation in the Future Forces Synthetic Environments (FFSE) Section. December 2002

4. Herdman, C.M., M. Gamble, K.G. Gladstone and A.L. Vallerand. Preliminary studies of real-time access to UAV Sensors: Alterations in situational awareness and workload of Tactical Air pilots. Unpublished observations.

5. Vallerand, A.L. and M. Thompson. 2004. Network centric Synthetic Environments: a modular M&S/ SE framework (DRDC Ottawa TM 2004-221), Defence R&D Canada – Ottawa.

DOCUMENT CONTROL DATA

(Security classification of title, body of abstract and indexing annotation must be entered when the overall document is classified)

1. ORIGINATOR (the name and address of the organization preparing the document. Organizations for whom the document was prepared, e.g. Establishment sponsoring a contractor's report, or tasking agency, are entered in section 8.)

Defence R&D Canada – Ottawa
3701 Carling Ave Ottawa ON K1A 0Z4

2. SECURITY CLASSIFICATION (overall security classification of the document, including special warning terms if applicable)

UNCLASSIFIED

3. TITLE (the complete document title as indicated on the title page. Its classification should be indicated by the appropriate abbreviation (S,C or U) in parentheses after the title.)

Synthetic Environments at the Enterprise level: Overview of a Government of Canada (GoC), Academia and Industry Distributed Synthetic Environment Initiative (U)

4. AUTHORS (Last name, first name, middle initial)

A.L. Vallerand, B. Kim, R. Youssef, P. Hubbard, D. Skinner, B. Murray, S. Poursina, C.M. Herdman, M. Gamble, L. Hagen, D. Bleichman, D. Kurts, R. Kruk, R. Lavoie and K. Gladstone

5. DATE OF PUBLICATION (month and year of publication of document)	6a. NO. OF PAGES (total containing information. Include Annexes, Appendices, etc.)	6b. NO. OF REFS (total cited in document)
April 2005	22	5

7. DESCRIPTIVE NOTES (the category of the document, e.g. technical report, technical note or memorandum. If appropriate, enter the type of report, e.g. interim, progress, summary, annual or final. Give the inclusive dates when a specific reporting period is covered.)

Technical Memorandum

8. SPONSORING ACTIVITY (the name of the department project office or laboratory sponsoring the research and development. Include the address.)

DRDC Ottawa

9a. PROJECT OR GRANT NO. (if appropriate, the applicable research and development project or grant number under which the document was written. Please specify whether project or grant)	9b. CONTRACT NO. (if appropriate, the applicable number under which the document was written)
13dj01	---

10a. ORIGINATOR'S DOCUMENT NUMBER (the official document number by which the document is identified by the originating activity. This number must be unique to this document.)	10b. OTHER DOCUMENT NOS. (Any other numbers which may be assigned this document either by the originator or by the sponsor)
DRDC Ottawa TM 2005-130	

11. DOCUMENT AVAILABILITY (any limitations on further dissemination of the document, other than those imposed by security classification)

(X) Unlimited distribution
( ) Distribution limited to defence departments and defence contractors; further distribution only as approved
( ) Distribution limited to defence departments and Canadian defence contractors; further distribution only as approved
( ) Distribution limited to government departments and agencies; further distribution only as approved
( ) Distribution limited to defence departments; further distribution only as approved
( ) Other (please specify):

12. DOCUMENT ANNOUNCEMENT (any limitation to the bibliographic announcement of this document. This will normally correspond to the Document Availability (11). However, where further distribution (beyond the audience specified in 11) is possible, a wider announcement audience may be selected.)

UNLIMITED DISTRIBUTION

13. ABSTRACT (a brief and factual summary of the document. It may also appear elsewhere in the body of the document itself. It is highly desirable that the abstract of classified documents be unclassified. Each paragraph of the abstract shall begin with an indication of the security classification of the information in the paragraph (unless the document itself is unclassified) represented as (S), (C), or (U). It is not necessary to include here abstracts in both official languages unless the text is bilingual).

A new partnership between the Government of Canada (GOC), Industry and Academia is working to help Canada become a world leader in Modeling and Simulation (M&S). The goal is to take SMARRT technologies - Simulation and Modeling for Acquisition, Requirements, Rehearsal and Training - and apply them to the development and improvement of Canadian Forces (CF) military systems and capabilities, as well as a vast host of civilian applications. To this end, the initial partners initiated the October 2004 UAV-NTS SE Interoperability Experiment, which links DRDC Ottawa's Uninhabited Air Vehicle Research Test Bed (UAV RTB) to a Carleton University Networked Tactical Simulator (NTS) modified with CAE Inc. synthetic environment (SE) assets including computer-generated forces. The experiment took place via a non-dedicated unclassified, though VPN-encrypted network over a period of several days. Prospective GOC, Academia and Industry partners, as well as foreign military personnel, attended these sessions. The goal was to show how M&S technologies can be used and made relatively easy at the national/enterprise level, and how lessons learned and technical best practices point to a bright future for distributed synthetic environment applications in Canada's Department of National Defence, as well as for DND's public security partners. This joint S&T report documents an overview of the M&S/SE standards and tools related to JSMARTS, the data stemming from aircrew being subjected to the experimental protocol as well as the technical data describing the connectivity and interoperability amongst participants. Finally, this overview is complimented by a short videoclip (available on the CD only).

14. KEYWORDS, DESCRIPTORS or IDENTIFIERS (technically meaningful terms or short phrases that characterize a document and could be helpful in cataloguing the document. They should be selected so that no security classification is required. Identifiers such as equipment model designation, trade name, military project code name, geographic location may also be included. If possible keywords should be selected from a published thesaurus. e.g. Thesaurus of Engineering and Scientific Terms (TEST) and that thesaurus-identified. If it is not possible to select indexing terms which are Unclassified, the classification of each should be indicated as with the title.)

Distributed Synthetic Environment; Government; Industry; Adademia; HLA; RTI, FOM; Simulation network.

Defence R&D Canada

Canada's leader in Defence
and National Security
Science and Technology

R & D pour la défense Canada

Chef de file au Canada en matière
de science et de technologie pour
la défense et la sécurité nationale

www.drdc-rddc.gc.ca