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

R&D Plan to Support the Application of the After-Action Review (AAR) Process Applied by the Observer-Controller Trainer Personnel of the Canadian Army

Final report of the Augmented AAR Project (12TL)

Éric Boivin
Marielle Mokhtari
DRDC Valcartier

Defence R&D Canada – Valcartier
Technical Report
DRDC Valcartier TR 2013-484
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Abstract

This report presents the research and development (R&D) work carried out under the *Augmented After-Action Review* project (in french *Revue post exercice de demain*) (2010-2013) authorized by the client group *2T - Integrated Analysis of Land Force*. The work supports the *Observer-Controller Trainer* (OCT) personnel of the *Canadian Army* (CA) in the learning and use of the *After-Action Review* (AAR) process. The report presents a R&D plan divided into three (3) topics aiming to: (1) reduce time and cost of training OCT personnel; (2) enhance operational capabilities of OCTs when dealing with the AAR process; and (3) extend the scope of feedback to the training audience when conducting AAR sessions.

Résumé

Ce rapport présente les travaux de *recherche et développement* (R&D) réalisés dans le cadre du projet *Revue post exercice de demain* (en anglais *Augmented After-Action Review)* (*2010-2013*) du groupe client *2T – Analyse intégrée de la force terrestre*. Les travaux réalisés appuient l'*observateur-contrôleur instructeur* (OCI) de l'*Armée canadienne* (AC) dans l'apprentissage et l'application du processus de *revue post exercice* (RPE). Le rapport présente un plan de R&D divisé en trois (3) thèmes explorant les bénéfices potentiels destinés à : (1) réduire les temps et les frais des activités de formation du personnel OCI; (2) bonifier les capacités opérationnelles du personnel OCI dans l'application du processus RPE; et (3) élargir la portée des rétroactions envers le personnel à l'entraînement lors de conduite de RPE.

Executive summary

R&D Plan to Support the Application of the After-Action Review (AAR) Process Applied by the Observer-Controller Trainer Personnel of the Canadian Army: Final report of the Augmented AAR Project (12TL)

Éric Boivin; Marielle Mokhtari; DRDC Valcartier TR 2013-484; Defence R&D Canada – Valcartier; December 2013.

Introduction: The chief *Observer-Controller Trainer* (OCT) of the *Canadian Manoeuvre Training Centre* (CMTC) in *Wainwright* oversees and promotes the use of the *After-Action Review* (AAR) process in the *Canadian Army* (CA). This authority shall ensure that each stage of the AAR process is performed according to the guidelines of the CA during training exercises. The chief OCT sees that his personnel has the knowledge and the appropriate technological means to fulfill his mission. In conjunction with the *Directorate of Land Requirements* (DLR), *Defence Research and Development Canada* (DRDC) *Valcartier* led a research and development (R&D) project aimed at exposing the potential of using of new information technologies (IT) in an operational view for OCT personnel. This project, named *Augmented After-Action Review* (or *Revue post exercice de demain*) (2010-2013), was authorized by the client group *2T - Integrated Analysis of Land Force*.

Results: This report presents six (6) R&D activities exploring the benefits that could bring new IT to the AAR process. These R&D activities aimed among other things:

1. reducing time and cost of training OCT personnel;
2. enhancing the operational capabilities of OCT personnel when applying the AAR process;
3. extending the scope of feedback to the training audience when conducting AAR sessions.

Deliverables: Besides a brief theoretical background of the AAR process used by the Canadian Army (CA), the report contains:

1. a plan including six (6) R&D activities supporting the application of the AAR process applied by the CA;
2. the completion status of each of these six (6) R&D activities proposed by DRDC Valcartier;
3. recommendations to guide OCT's authority in defining its future operational capability.

Future plans: The final content of this report did not necessarily received the approval or support of CMTC. Therefore, this report will be forwarded to the OCT authority of the CA in order to obtain his view on these R&D activities.

Sommaire

R&D Plan to Support the Application of the After-Action Review (AAR) Process Applied by the Observer-Controller Trainer Personnel of the Canadian Army: Final report of the Augmented AAR Project (12TL)

Éric Boivin; Marielle Mokhtari ; DRDC Valcartier TR 2013-484 ; R&D pour la défense Canada – Valcartier; décembre 2013.

Introduction: Le chef *Observateur-contrôleur instructeur* (OCI) du *Centre canadien d'entraînement aux manœuvres* (CCEM) à *Wainwright* encadre et promeut l'utilisation du processus de *Revue post exercice* (RPE) au sein de l'*Armée canadienne* (AC). Cette autorité s'assure que chacune des étapes du processus RPE est exécutée selon les directives de l'AC lors d'exercices d'entraînement. Ainsi, le chef OCI voit à que son personnel dispose des connaissances et des moyens technologiques adéquats afin de remplir sa mission. De concert avec le *Direction des besoins en ressources de l'armée de terre* (DBRT), *Recherche et développement pour la défense Canada* (RDDC) *Valcartier* a mené un projet de *recherche et développement* (R&D) ayant pour but d'exposer l'apport que pourrait avoir l'exploitation des nouvelles *technologies de l'information* (TI) dans les activités opérationnelles du personnel OCI. La conduite de ce projet, portant le nom de *Revue post exercice de demain* (ou *Augmented After-Action Review*) (2010-2013), a été autorisé par le *groupe client 2T – Analyse intégrée de la force terrestre*.

Résultats: Ce rapport présente six (6) initiatives de R&D explorant les bénéfices que pourraient apporter les nouvelles TI dans l'application du processus RPE. Ces initiatives de R&D visent entre autres à:

1. réduire les temps et les frais des activités de formation du personnel OCI;
2. bonifier les capacités opérationnelles des OCIs dans l'application du processus RPE;
3. élargir la portée des rétroactions envers le personnel à l'entraînement lors de conduite de RPE.

Livrable: Outre un bref rappel théorique du processus RPE appliqué par l'AC, ce rapport contient:

1. un **plan de R&D** comprenant six (6) activités de R&D supportant l'application du processus RPE utilisé par l'AC;
2. l'**état d'avancement** de chacune des six (6) activités de R&D proposées;
3. des **recommandations** destinées à guider l'autorité OCI dans la définition de sa capacité opérationnelle future.

Perspectives: Le contenu final de ce rapport n'a pas nécessairement reçu l'approbation ou l'appui du CCEM. Par conséquent, ce rapport sera transmis à l'autorité OCI de l'AC afin d'obtenir leur avis sur les initiatives de R&D présentées.

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1 Introduction

Canadian Army (CA) has invested efforts in the implementation and institutionalization of the *After-Action Review* (AAR) process within their training activities. This initiative aims to increase the benefit of training by providing independent feedback to commanders and trainees. CA has mandated the *Observer-Controller Trainer* (OCT) personnel as a mean to accompany units in the application of the AAR process. Their duties include, among others, identifying training objectives, observing events, collecting data, controlling activities, performing data analysis, teaching doctrine, coaching and mentoring. Considering the workload they face, CA is looking for means to ease or simplify OCT's duties. Emerging technologies such as smart devices, tablets and cloud systems are few examples that could bring opportunities to lighten OCT's workload.

Meanwhile, CA is involved in modernization effort of their training systems where technologies and simulation are taking more space. The acquisition of *Virtual Battle Space 2* (VBS2) simulator (Bohemia Interactive Simulations, 2011) for virtual training, and the deployment of the *Canadian Weapon Effects Simulation system* (CWES) (Cubic Field Services Canada Ltd, 2005) for live training are two examples that confirm the trend. OCT personnel should be aware of these new training capabilities in order to support the achievement of their responsibilities.

The working environment of OCT personnel is evolving. Emerging technologies and modern training systems do not only influence the way to do training, but also the way to perform the AAR. The *Augmented After-Action Review* (AAAR) project, led by *Defence R&D Canada* (DRDC), aims to support the AAR process by taking into account of these technological improvements in order to develop OCT's competencies and to enhance his efficiency.

The next section presents a general overview of the AAR process as defined and operated by CA. Thereafter, a list of potential technological improvements is suggested to support the application of the AAR process. Finally, a conclusion summarizes accomplished work and presents future actions.

2 Theory : The AAR process

2.1 Overview

Approximately thirty years ago, the U.S. Army began to develop the "AAR concept" as part of the redesign of its training strategy. This redesign initiative occurred just after the Vietnam Conflict and originates directly from it. "At the peak of the conflict it became apparent that foot soldiers in the field had far more knowledge about what was going on than headquarters. AARs were introduced to pass timely relevant learning within and between teams of soldiers at times when waiting for a full evaluation report would mean waiting too long" (Collison & Parcell, 2001).

Throughout these thirty years, the original AAR concept, an unstructured debrief after an event/operation, has evolved up to a structured process encompassing the event/operation to dissect (US Army Combined Arms Center, 2011). Today, the AAR process is considered as one of the most important phases of the training process and a tool to facilitate "learning while doing", to improve team working, to increase confidence in leader and also to lead to a more cohesive and proficient armed force. This process has helped the U.S. Army to accumulate success in sustaining and improving performance at all levels (individual, collective, operational, strategic...). "Originally developed to support training exercises, the AAR is now used within the U.S. Army for purposes ranging from improving operations efficiency to dealing with the impact of frequent assignment rotations. It is viewed as an expression of core Army values such as readiness and leadership" (Parry & Darling, 2001).

Furthermore, the AAR process is viewed as the best example of a long-lived *emergent learning* practice used by a team to improve its planning and performance. "The practice is simple and repeated; the team uses its own current challenges as its field for learning; and the team relies on tapping into its own experiences and shared thinking as the primary vehicle for improvement. With such a practice, learning *emerges* from the team's own work, rather than (or in addition to) coming from the traditional method of classroom education. An emergent learning practice creates immediate performance gains while simultaneously building a team's capacity for improvement and generating as a second-level artefact a body of validated *lessons learned*. Simply put, emergent learning is about getting better at getting better by weaving learning into ongoing work. AARs are the best example we have uncovered of a long-lived (more than 19 years) emergent learning practice. It is our study of this practice from which we have adopted this article (M. Darling & Parry, 2004)" (M. J. Darling & Parry, 2001).

Considering the U.S. Army success, the other U.S. military services and the Civilian sector have rapidly adopted the AAR model (M. J. Darling & Parry, 2001) (Gilion, 2010) (Buchanan, 2009) (Graham, 2001).

2.2 Canadian AAR Process

The Canadian AAR process is a direct adaptation of the U.S. AAR process. The first documents related to the AAR process appeared in the 90's and were written and published by the *Canadian Army Lessons Learned Center* (ALLC) (ALLC / CLRA, 1999). But, the AAR process (and

related activities) is no longer governed by ALLC but is the responsibility of the *Canadian Manoeuvre Training Centre* (CMTC). Documents and information are currently available on both websites (ALLC / CLRA, 2012a) (CMTC / CCEM, 2012a), but a part is redundant due to the duplication of the effort on a certain laps of time.

Since its official introduction in the CA training, the Canadian AAR process has evolved to become a well-established sequential four phase process used as well for *live, virtual, constructive* (LVC) as blended training (from the first Canadian documents (ALLC / CLRA, 1999) (Morrell, 1999) to the most official ones (ALLC / CLRA, 2012a) (CMTC / CCEM, 2012a)). The AAR process can be applied at all levels, from individual to brigade and higher. The four phases are: Planning (before the *Training Session* (TS), in close collaboration with the training personnel), Preparation, Conduct (both during the TS) and Follow-Up (after the TS). The Conduct phase, the AAR itself, is the most visible aspect of the process because leader and soldiers (TS audience) are gathered to discuss about the TS. This phase should not be considered as a critique, a typical post-mortem or retrospective. It is not a gripe session or intended to fix blame and embarrass anyone. The AAR goal is not to limit the discussion to an assessment of TS failure or success. The AAR is a living learning practice and has to be leader-guided, soldier-centered, focused on learning objective.

Figure 1 summarizes the Canadian AAR process, its phases and their key activities, as it is applied for each TS. Figure 2 presents some examples of available software systems used during the TS (Preparation phase) and during the AAR session itself (Conduct phase). CWES (Cubic Field Services Canada Ltd, 2005) captures the status and actions of units during a live training. VBS2 (Bohemia Interactive Simulations, 2011) training simulator integrates similar functionalities to address the virtual training purpose. Finally, Joint Conflict and Tactical Simulation (JCATS (U.S. Joint Forces Command (USJFCOM), 1997))-based exercises benefit of Aramis (SimFront Corporation, 2007), a replay software, to analyse and capture key training events for constructive training. During the AAR session, some replay artefacts are used to support the discussion. Other supporting mediums are combined to support the discussion.

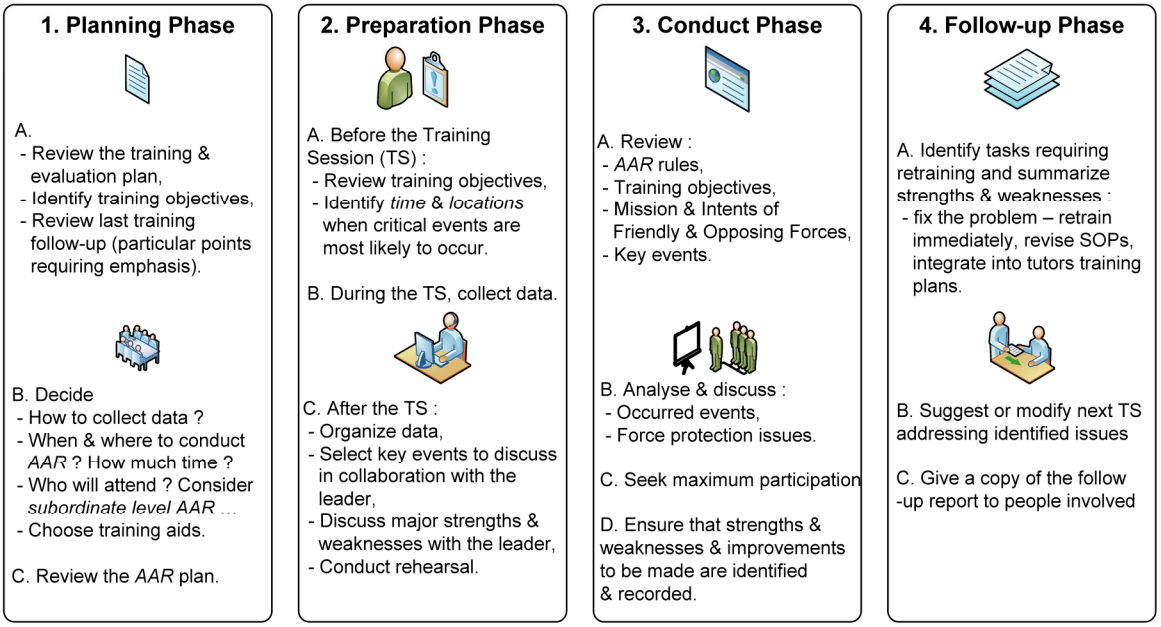


Figure 1: (Typical) AAR Process and OCT's duties/activities

Figure 2: Example of available systems for LVC training exercises and AAR sessions

2.3 AAR Process and Facilitators - OCTs

Like all learning activities involving feedback and "formal evaluation", the AAR process requires highly qualified personnel to help to dissect what the leader and soldiers do not have done adequately during the TS. In the CA, these qualified personnel are called OCTs. Generally, OCT is an experienced soldier who accompanies an organization during training. Normally OCT personnel are not from the immediate chain of command of the organization being supported. They have the ability to provide independent feedback as they have no stake in the outcome of the training. The ultimate purpose of OCT is: to enable the TS audience and the Army to learn more from a training event; to enable the training director to monitor all facets of the TS (training) in order to adjust the TS activities and tempo as necessary; and to assist commanders in the conduct of confirmation. OCT's responsibilities are to observe, control, teach, coach, and assist in the confirmation. OCT's duties spread over the AAR process, from the pre-training (the *Planning* phase) to the post training (the *Follow-Up* phase). OCT's responsibilities require strong competencies in verbal and written communication, leadership, teamwork and also well-developed analysis and synthesis skills. Figure 1 details the tasks performed by the OCTs within the four phases of the AAR process. These tasks are realized either individually, in collaboration with the training personnel itself, in synergy with the whole OCT team and finally in active participation with the TS audience. Further details about OCTs are directly available on the ALLC and CMTC websites (ALLC / CLRA, 2012b) (CMTC / CCEM, 2012b).

2.4 Benefit of the AAR Process

The AAR process is the cornerstone of the learning in training. The peak of the process is the AAR session, the most tangible aspect because AAR sessions gather the team, its leaders and the facilitators to address questions about actions during the TS. Leaders should seize this gathering opportunity to strengthen the confidence of the team by encouraging them to identify positive performing changes. An AAR session is not a punctual activity occurring when time permits. It is an activity planned before the training (for each scheduled TS), from the perspective that learning and improvement must happen throughout the training. The AAR process is a continuing practice that is focused in the long-term, generating lessons to be learned and applied immediately (local benefits), in the mid-term, and over the long run. Figure 3 shows the links that can be drawn between the key players of a TS, the TS audience (i.e. the team and its leader) and the facilitators (i.e. OCTs). The TS supported by the AAR process identifies failures and proposes corrective actions appropriated to similar events / exercises or not. The course of a TS not supported by the AAR process (neither by the OCT personnel) will never lead a team to a level of experience as high as when the AAR process (driven by the OCT personnel) is applied (Parry & Darling, 2001).

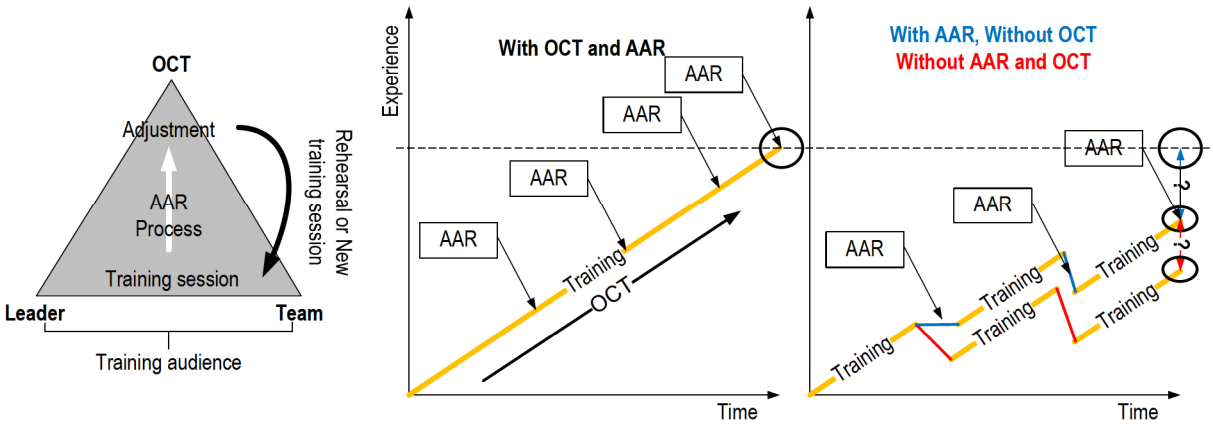


Figure 3: AAR Process Benefit – (Left) The necessary intricateness, (Middle) The right balance, (Right) The performance loss.

3 OCT's R&D Activity Plan

3.1 Introduction

This section describes the followed path that led to the identification of selected R&D activities for this project. The definition of the *OCT's R&D Activity Plan* was phased in over a period of about two years. A first version of the *OCT's R&D Activity Plan* was produced in 2010 (Boivin & Mokhtari, 2011) for the NATO MSG-087 Symposium.

This chapter presents a revision of the plan and a summary of invested efforts for each R&D activities. First, section 3.2 summarizes events that contribute to collect needs for the project. Thereafter, a list of eight (8) issues (repeatedly mentioned during these events) has been compiled in order to guide the scope of the *OCT's R&D Activity Plan*. Based on these issues, six (6) R&D activities were identified and grouped under three (3) main objectives (section 3.3). Finally, a progress status of each R&D activities allows appreciating the completed work to date.

3.2 OCT's needs

Client needs was gathering by participating to three (3) CA exercises and several CA personnel meetings and trainings. Table 1 summaries events held and partners met.

Table 1: Summary of events held to collect client needs

Event no.	Event type (*Date*)	Description	Principal collaborators
1.	Client meeting *(Oct'09)*	Discussions: AAR system needs	Maj J. Vaillancourt – DLR 6-5
2.	Conference call *(Jul'10)*	Discussions: General OCT needs	LCol R. Lessard – CMTC
3.	Exercise, Client meeting *(Sep'10)*	Attending EX MAPLE GUARDIAN'10 - Attend to 3 TS with OCTs - Attend to 3 AAR sessions - Introduction to *CWES* system and *Cubic* facility - Discussions: OCT needs	LCol R. Lessard – CMTC Maj G. Abthorpe – CMTC WO L. Hill – CMTC
4.	Training *(Oct'10)*	Conducting specific AAR sessions with VBS2	Capt J. Robin-Thériault – LFQA TC
5.	Expert meeting *(Oct'10)*	Discussions: OCT and AAR system needs	Capt J. Robin-Thériault – LFQA TC

6.	Training *(Dec'10)*	Introduction to the CA AAR process	Maj E. Cellier – LFQA TC Capt J. Robin-Thériault – LFQA TC Mr B. Côté – LFQA TC
7.	Exercise *(Mar'11)*	Attending EX LION NUMERIQUE'11 - Attend to 1 TS with OCTs - Attend to 1 AAR sessions - Introduction to *Aramis* AAR System	Mr S. Reid – SimFront Mr C.Watson – SimFront
8.	Exchange of emails *(Sep'11)*	Obtaining *CWES* documentation	Mr G. Hamel – DCSEM 8-3
9.	Training *(Oct'11)*	Introduction to C2 digitization (ref.:Battleview suite)	Capt P. McLean – LFQA TC
10	Expert meetings (x10) *(Oct'11 to Jun'12)*	Discussions: OCT and AAR system needs	Mr B. Côté – LFQA TC
11.	Exercise *(Mar'12)*	Attending EX LION NUMERIQUE'12 - Attend to 2 TS - Attend to 1 AAR session - Discussions on training systems	Capt P. McLean – LFQA TC Mr R. Sneddon – Calian Tech Ltd.
12.	Expert meeting (*Mar'12)*	Discussions: Evolution of CWES system	Mr S. Forgues, P. Eng – DCSEM 7
13.	Client meeting (*May'12)*	Discussions: OCT needs (Land Ops'12) - Withdrawal of the CMTC support for the AAAR project	LCol J. Pospolita – CMTC

These events revealed many issues affecting the application of the AAR process by OCTs. The participation as an observer to the *Ex Maple Guardian'10* (event no. 3) and the guidance of an OCT expert (event no. 10) are the two major events that contribute to identify the top issues raised by our collaborators. Others events mainly helped to confirm and refine previous observations. Table 2 lists the top eight (8) issues retained for this project that completed the need collection step.

Table 2: Top issues raised by DLR 6-5, CMTC, CEES and DRDC – Valcartier

Issues	Associated AAR process phases	Issue raised	
		by	during (event no.)
A. Benefits of OCT and AAR process stay unknown and/or misunderstood by commandant of EX	Planning phase and Follow-up phases	CMTC LFQA TC	2. - 3. - 10.
B. Transversal competencies (i.e. speaking skill, leadership …) are not considered when assigning tasks to OCT personnel	Planning phase	CMTC LFQA TC	3. - 5. - 10.
C. There is not enough full-time OCT personnel to manage large EXs	Planning phase	CMTC	2. - 3.
D. OCT personnel use stovepipe technologies to capture evidences that overload their duties	Preparation phase	DLR 6-5 CMTC LFQA TC DRDC – Val.	1. - 3. - 8. - 9. - 10. - 12.
E. AAR systems provide raw data complex to exploit	Preparation phase	DLR 6-5 DRDC – Val.	1. - 3. - 7. - 8. - 11 - 12.
F. Little time is allowed to produce content of AAR session	Preparation phase	CMTC LFQA-TC DRDC – Val.	3. - 5. - 6. - 10.
G. Trainees admit their mistake only if they see it	Conduct phase	CMTC LFQA-TC	3. - 4. - 5. - 10.
H. Follow-up reports stay unused	Follow-up phase	LFQA-TC	6. - 10.

Table 2 reveals that client raised several concerns about the execution of the *Planning* and the *Preparation* phases of the AAR process. Issues related to the *planning phase* address concerns associated to the development of OCT's competencies, while issues related to the *preparation phase* address concerns associated to the efficiency of technological tools used by OCTs. At last, the benefits of the AAR process and the usefulness of follow-up report seem misunderstood by commandant of EX. In general, clients said few follow-up reports are usually produced, distributed and reused.

3.3 Objectives & Activities

Faced with these issues presented by Table 2, three (3) *objectives* were defined to develop the core of the second version of the *OCT's R&D Activity Plan* (Table 3). In addition, six (6) *R&D Activities* are identified to tackle raised issues. Objectives and R&D activities are described in section 3.4.

Table 3: OCT's R&D Activity Plan

Objectives	R&D activities	R&D fields
a. Support OCT's competencies development (WBS 1)	1. Optimize OCT's training schedule (WBS 1.1)	Presentation design Interactive learning e-learning
	2. Design and model an interactive OCT's learning tool (WBS 1.2)	
b. Augment OCT's capabilities (WBS 2)	3. Explore smartphone devices capabilities for OCTs (WBS 2.1)	Technology assessment Software design
	4. Digitalize and virtualize the AAR process (WBS 2.2)	
c. Explore innovative ways to present evidences (WBS 3)	5. Enhance AAR visualization (WBS 3.1)	Visualization Serious gaming Augmented reality Biofeedback monitoring
	6. Provide innovative state reviews (WBS 3.2)	

Note that the *OCT's R&D Activity Plan* does not suggest any change to the AAR process itself. Suggested objectives and R&D activities aim to assist the OCT personnel into their duties and to help them in their own learning. The proposed R&D activities are supported by technological innovation domains not limited to presentation design, interactive learning, e-learning, technology assessment, software design, visualization, serious gaming, augmented reality (AR), biofeedback monitoring and digitalization.

A matrix was produced to qualify witch *R&D activities* answer to *raised issues* (Table 4). The value "D", stands for "*Directly*", means that the *R&D activity* can contribute to solve the raised issue while "I", stands for "*Indirectly*", means that the *R&D activity* could contribute to mitigate the raised issue.

Table 4: Matrix of suggested R&D activities versus raised issues

R&D Activities \ Issues	A. Benefits of OCT and AAR process stay unknown and/or misunderstood by commandant of EX	B. Transversal competencies (i.e. speaking skill, leadership …) are not considered when assigning tasks to OCT personnel	C. There is not enough full-time OCT personnel to manage large EXs	D. OCT personnel use stovepipe technologies to capture evidences that overload their duties	E. AAR systems provide raw data complex to exploit	F. Little time is allowed to produce content of AAR session	G. Trainees admit their mistake only if they see it	H. Follow-up reports stay unused
1. Optimize OCT's training schedule		I	**D**					
2. Design and model an interactive OCT's learning tool	I	**D**	I					
3. Explore smartphone devices capabilities for OCTs				**D**		I	I	
1. Digitalize and virtualize the AAR process	I		I	I	I	**D**		**D**
2. Enhance AAR visualization				I	**D**		I	
3. Provide innovative state reviews							**D**	

D = R&D Activity directly contribute to solve the issue.
I = R&D Activity indirectly contribute to solve the issue.

Note that no R&D activity was proposed to directly tackle issue "A". The promotion of the benefits of the AAR process across CA is under the responsibility of the CMTC. However, the design of an interactive learning tool could indirectly support this issue by making available an engaging learning method for future OCTs. Regarding other issues, at least one R&D activity directly tackles each of them.

For each *R&D activity*, Table 5 specifies the level of completion and identifies the major contributors. No contributor means that no effort was invested on *the given level of completion*. Note that some level of completion could include more than one deliverables.

Table 5: Progress status of R&D activities conducted under 12TL

R&D Activities \ Level of completion	**Initiate** (Delivery of a feasibility study, analysis., investigation …)	**Develop** (Delivery of an architecture , a prototype, …)	**Evaluate** (Delivery of a preliminary capacity)
1. Optimize OCT's training schedule	LFQA TC DRDC V	LFQA TC	
2. Design and model an interactive OCT's learning tool	DRDC V LFQA TC	DRDC V	
3. Explore smartphone devices capabilities for OCTs	LFQA TC DRDC V		
6. Digitalize and virtualize the AAR process			
4. Enhance AAR visualization	DRDC V	DRDC V	
5. Provide innovative state reviews	DRDC V		

3.4 Work Breakdown Structure

Figure 4 presents the *Work Breakdown Structure* (WBS) view of the *OCT'S R&D Activity Plan*. Uninitiated or uncompleted tasks are due to a premature termination of the project. Unfortunately, the last client meeting held in May'12 ended up with the withdrawal of the CMTC support for AAAR project. CMTC argued a shift in its R&D strategy involvement. Therefore, AAAR project was stopped and budget for the remaining year (2012-2013) was assigned to support others DRDC research projects.

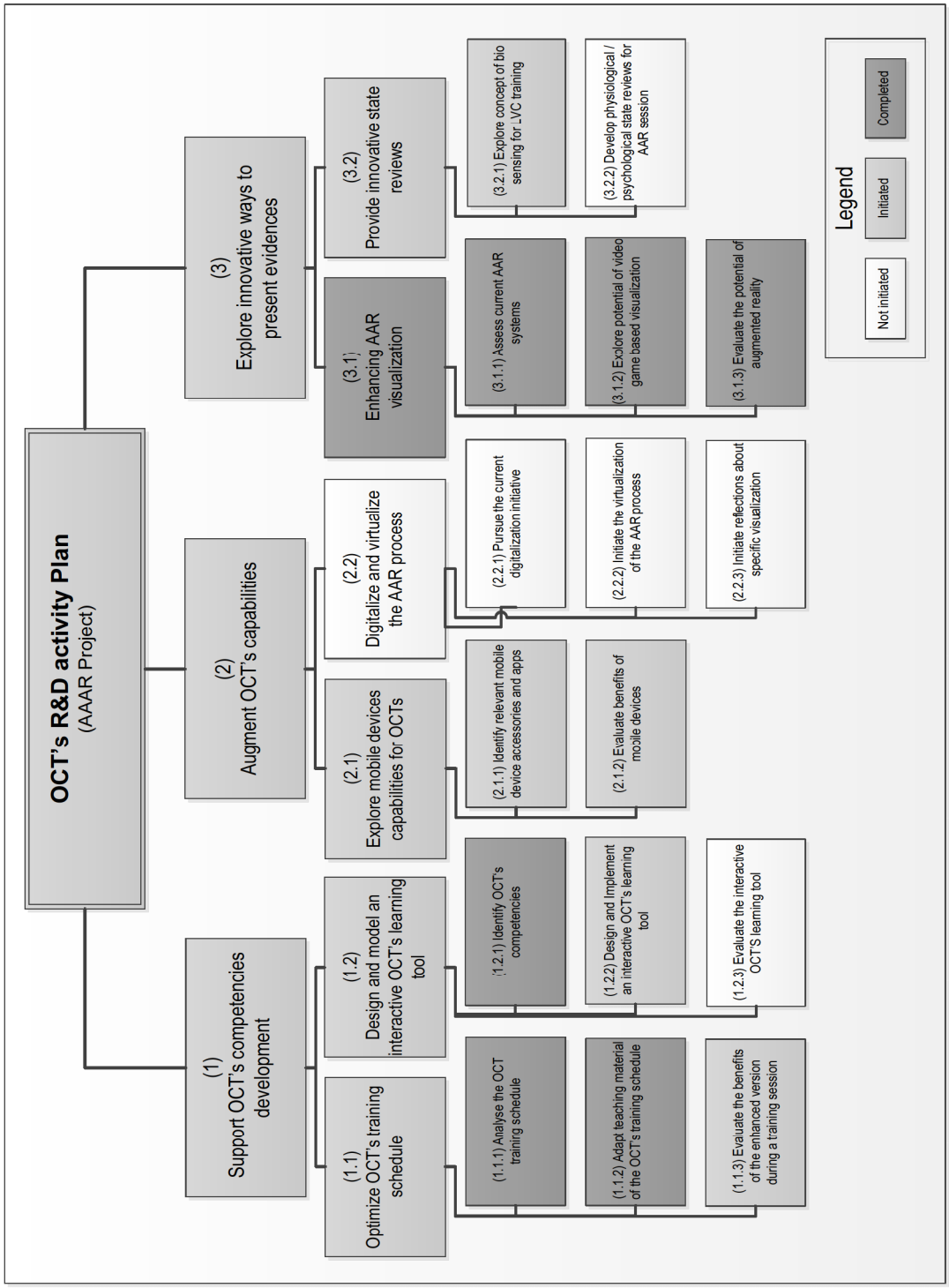


Figure 4: WBS of the AAAR project

Following section details each WBS elements of the *OCT's R&D Activity Plan.*

WBS 1 - Support OCT's competencies development

Currently, OCT's training is supervised by the permanent OCT's unit based in *Canadian Forces Base* (CFB) Wainwright (Figure 5). OCT's knowledge is wrapped into a 3 day-course called the OCT's Academy class. A formal certification is granted to participants that pass the final exam[1]. Senior OCTs travel across the country to provide instruction. CMTC also counts on several certified experts located in various CFBs to train new staff or refresh part-time OCTs knowledge.

Because resources and time always want to be optimized, WBS 1 presents two (2) R&D activities aiming to support CMTC into the development of OCT's competencies. According to chief OCT, no changes were made to the AAR process and to the way to conduct it. It is important to note that these R&D efforts do not suggest to supress any theoretical or practical learning activities. Instead, WBS 1 relies on modern teaching approaches in order to reduce required training time and/or to improve OCT's awareness in action. Following sections summarizes these R&D activities addressing issues strongly raised by Chief OCT during the *Maple Guardian 2010 EX*.

Figure 5: An OCT team that executes the planning phase of the AAR process[2].

[1] The exam is conducted in 45 mins without any ref materials. It is a multiple choice exam consisting of 30 questions, 1 point per correct answer. Passing grade is 60% or 18 of 30 questions answered correctly (CMTC, 2010).

[2] Example of AAR report is available in Annex D.

WBS 1.1 - Optimize OCT's training schedule

This R&D activity is composed of three (3) *WBS elements* where two (2) has been completed (Table 6). Level of completeness of each WBS is detailed under.

Table 6: Summary of R&D WBS 1.1 "Optimize OCT's training schedule"

R&D Activity	Optimize OCT's training schedule
Expected outcome	Support OCT's competencies development
Main issue addressed	**C. There is not enough full-time OCT personnel to manage large EXs**
WBS elements	1.1.1 Analyse the OCT training schedule *(Completed)* 1.1.2 Adapt teaching material of OCT training plan *(Completed)* 1.1.3 Evaluate the benefits of the enhanced version during a TS *(Initiated)*
Progression status	**Ready to evaluate benefits of the enhanced version of the OCT's lecture**
Involved organisations	**Leader**: LFQA TC **Collaborator**: DRDC – Valcartier

The chief OCT in CMTC *Wainwright* wishes to optimize the training of future part-time OCTs by using assisted learning techniques. DRDC – *Valcartier* consulted the *Land Force Quebec Area* – (LFQA) *Training Centre* (TC) to learn about the innovative teaching approach they developed to train future OCTs. The teaching materials of the OCT training plan (ref. A-P3-003-OCT/PH-B01) of the CA was adapted in order to replace live training exercises by classroom exercises supported by *Virtual Battlespace 2* (VBS2), a virtual training platform.

WBS 1.1.1 - Analyse the OCT training schedule *(Completed)*

WBS 1.1.1 analyses the current OCT training schedule promoted by CMTC and described into the training plan *A-P3-003-OCT/PH-B01 – Observer-Controller Trainer* (LFDTS / SDIFT, 2009). This plan reveals that one day is required to teach theoretical concepts and almost two days to practice four (4) outdoor exercises. In addition, one day prior the training class is required to setup the training environment and to practice scenarios. According to chief OCT, the current training approach succeeds to provide realistic outdoor training experiences and to foster group cohesion. However, setting up live TS represents a significant financial burden: military personnel and equipment must be mobilized; supporting actors must be hired; training scenarios must be practiced; trainees should spend time to move out on the training site; and so on… In addition, poor scenario execution or bad weather conditions may affect learning. Table 7 summarizes CMTC training schedule.

Table 7: OCT Training – CMTC schedule

CMTC *(Qualification)*	***Day - 1***	***Day 0***	***Day + 1***	***Day + 2***
AM (9h-12h)	Event preparation and practice	Lectures	Event and AAR 1	Event and AAR 3
PM (13h-16h)	Event preparation and practice	Demo Event Demo AAR Reporting procedure	Event and AAR 2	Assessments Course critics

At LFQA TC, the *Area Simulation Center* (ASC) has the mandate to teach the OCT training plan (LFDTS / SDIFT, 2009). Most of the time and according to operational needs, ASC provides familiarization more than formal training to participants. Formal training gives participants a qualification, while familiarization helps participants to refresh their knowledge on the AAR process.

ASC developed an optimized training schedule over two days instead of four (Table 8). In order to limit resources involvement, ASC has replaced outdoor exercises by virtual ones given in a classroom environment. Training exercises were extracted from various official *Canadian Armed Forces* (CAF) publications (Appendix A) and were modeled within VBS2. Errors were deliberately inserted into scenarios to stimulate discussions over AAR sessions.

Table 8: OCT Training – LFQA TC / ASC schedule proposal

LFQA TC *(Familiarization)*	***Day - 1***	***Day 0***	***Day + 1***	***Day + 2***
AM (9h-12h)		Lectures Reporting procedure	Event and AAR 2 Event and AAR 3	
PM (13h-16h)		Demo Event Demo AAR Event and AAR 1	Event and AAR 4 Event and AAR 5 Assessments Course critics	

By using virtual exercises instead of live ones, ASC observed these potential benefits:

- The preparation day prior the training class is no longer required to setup the training environment and to practice exercises;
- The cost associated to the mobilization of equipment and the hiring actors is no longer required;
- Participants do not have to spend time to move out to attend exercises;
- The risks associated to weather hazards and the quality of actor delivery are withdrawed;
- Outstanding virtual point of views could be provided to participants in order to strengthen their understanding of a given scenario.

Here, the ASC proposal aims to accelerate learning by using virtual training scenario. However, if the training goal is to provide OCTs a live training experience on the field, CMTC approach should be privileged.

WBS 1.1.2 - Adapt teaching material of OCT training plan *(Completed)*

Based on ASC findings in section WBS 1.1.1, the teaching material of the original OCT training plan (A-P3-003-OCT/PH-B01 - OCT (LFDTS / ASG, 2009)) was adapted into a new *Microsoft PowerPoint* presentation. Changes were made regarding the content coverage order and the graphical appearance. ASC succeeds to combine both official languages into a single presentation in order to meet the linguistic reality of the CA. Figure 6 to Figure 9 provide a quick overview of the main presentation.

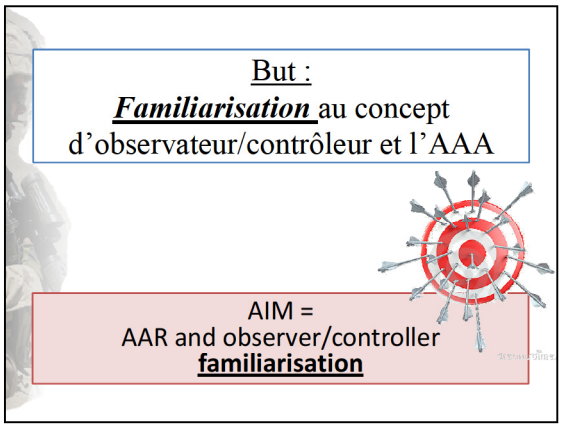


Figure 6: Slide of the LFQA TC training presentation – Aim

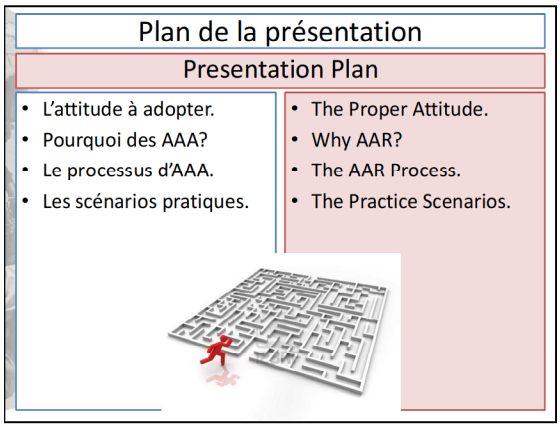


Figure 7: Slide of the LFQA TC training presentation – Outline

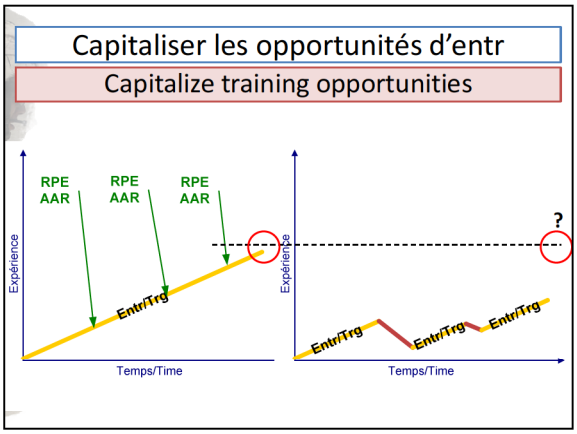


Figure 8: Slide of the LFQA TC training presentation – Capitalize training opportunities

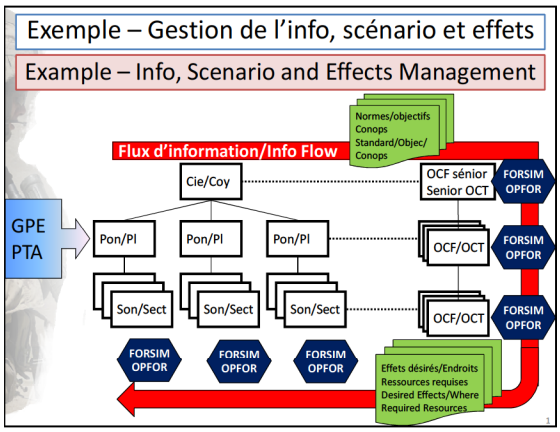


Figure 9: Slide of the LFQC TA training presentation – Info, Scenario & Effects Management

Outdoor exercises included under the original training plan were replaced by virtual one. Seven (7) exercices were designed: (1) *Vehicule control point* (VCP); (2) *Convoy and IED*; (3) *Landing zone*; (4) *Ambush and counter-ambush*; (5) *Cordon and search*; (6) *Clearing a street* and (7) *Defence*. Therefore, seven (7) *Microsoft PowerPoint* presentations, including many images and videos generated by VBS2, were created. An overview of the VCP exercice is depicted from Figure 10 to Figure 13.

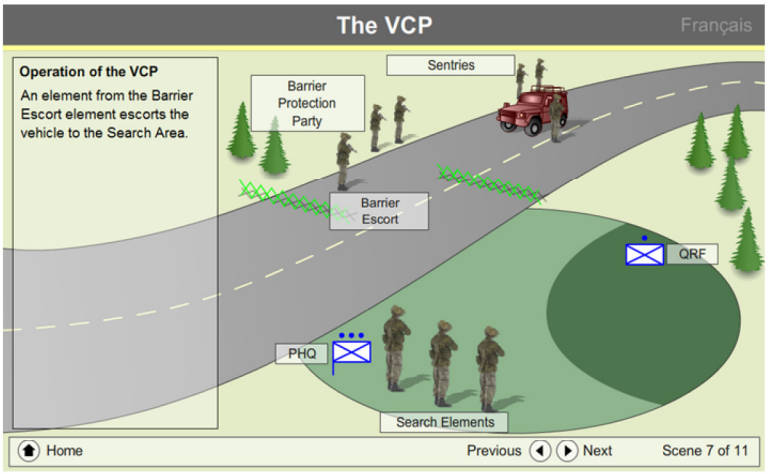


Figure 10: Assisted learning tool used for teaching the VCP concept (slide 7 of 11)[3]

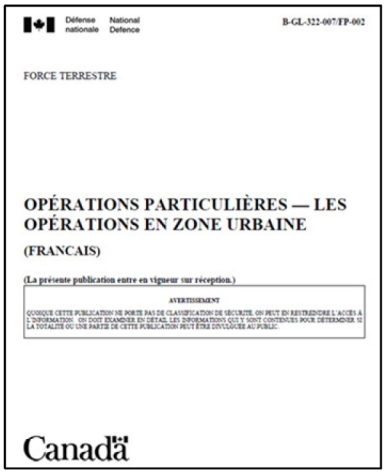


Figure 11: Reference used for developing the VCP exercise (Unique Operations – Urban)[4]

Figure 12: Map view of the VCP exercise

Figure 13: Key events of the VCP exercise

Unfortunatly, the content of WBS 1.1.2 is the result of a local initiative of ASC and it did not necessarily receive the approval or support of CMTC, responsible for the AAR process. Therefore, this R&D effort (Côté, 2012) was communicated to the OCT authority of the CA in order to obtain his views on this innovative training approach terms of cost, time and risk management.

[3] See reference (CTC Gagetown, 2010).
[4] See reference (DAD / DDAT, 2006).

WBS 1.1.3 - Evaluate the benefits of the enhanced version during a TS *(Initiated)*

Benefits and limitations of ASC approach were informaly obtain during two (2) TS:

- *Watchdog Vigilant EX* (September 10th 2012).
  Given to the *5 Military Police Regiment;*
- *Noble guerrier EX* (September 22th 2012, and November 24th 2012).
  Given to the *35 Canadian Brigade Group*.

Table 9 sumarizes observed differences between CMTC and ASC approaches.

Table 9: Informal differences between CMTC versus ASC teaching approaches

	Benefits	***Limitations***
CMTC *(Live exercises)*	• Rallying training that brings participants together • Foster team cohesion	• Required preparation time for demo and events • Mobilization of equipment and, engagement of actors • Training effects influenced by actor performing and weather hazards
LFQA TC *(Virtual exercises)*	• No preparation time • Compressed training time • More training events • Reduced impact of human resources • Reproducible demo and events • Teaching materials can serve as a reference for refresh	• Virtual experience (less realistic than live one)

Although informal observations are positive, these expected gains should be evalutaed through a formal experimental study. This next step would provide to OCT autority an objective understanding of observed benefits and limitations.

Based on a previous experiment involving virtual training (Bernier, Bouchard, & Boivin, 2013), a total of 50 participants is suggested to conduct a formal assessment of both approaches[5]. Figure 14 depicts the distribution of required participants. Typically, participants are randomly assigned to one of the two groups: (1) Control group (CMTC approach) where live exercises are offered, or

[5] Note that any experiment intent involving human aspects (i.e. learning) must be submitted to DRDC Human Research Ethics Committee.

(2) Experimental group (ASC approach) where virtual exercises are offered. 20% of invalid results (i.e. 5 participants per group) is foreseen to prevent deployed, injured and sick participants. For the time being, no efforts were invested to draft the experiment protocol.

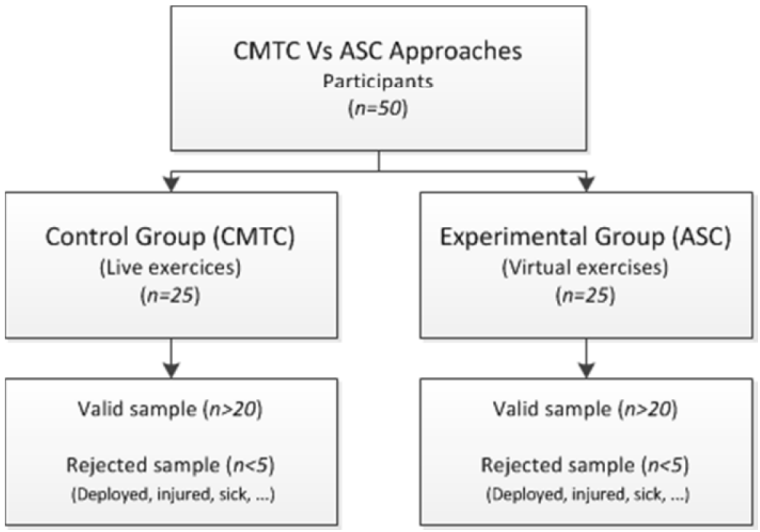


Figure 14: Participants' flowchart for WBS 1.1.3.

This closes WBS 1.1.

WBS 1.2 - Design and model an interactive OCT's learning tool

This R&D activity is composed of three (3) *WBS elements* where one (1) has been completed and one (1) has been initiated (Table 10). Level of completeness of each WBS is detailed under.

Table 10: Summary of WBS 1.2. "Design and model an interactive OCT's learning tool"

R&D activity	Design and model an interactive OCT's learning tool
Expected outcome	Support OCT's competencies development
Main issue addressed	**B. Transversal competencies (i.e. speaking skill, leadership …) are not considered when assigning tasks to OCT personnel**
WBS elements	1.2.1 Identify OCT's competencies *(Completed)* 1.2.2 Design and implement an interactive OCT's learning tool *(Initiated)* 1.2.3 Evaluate the interactive OCT's learning tool *(Not initiated)*
Progression status	**Intermediate**.
Involved organisations	**Leader**: DRDC – Valcartier **SME**: LFQA TC

Large training exercises (such as *Maple Guardian 2010 EX* (CMTC / CCEM, 2012c)) require part-time OCTs. CMTC provides the essential foundations of AAR process theory through its three-day *OCT Academy class*. Unfortunately, part-time OCTs are hard to find and require time to train. The training schedule could be reduced by introducing short e-learning sessions to complete prior the formal training class. Thereby, basic OCT and AAR concepts could be taught through individual online sessions. Here, the idea is not replace the formal training class, but to provide flexible learning options.

Besides the fact that e-learning sessions could be used for supporting training of future OCTs, these sessions are a perfect time to identify good candidates for key positions to fill during an EX. For instance, candidate having a strong leadership skill could be prefer to conduct an AAR session in front of a military audience, while good writing skill could be prefer to prepare lessons learned sessions. Currently, transversal competencies are not considered when assigning tasks to OCTs. A simple assessment of key transversal competencies could help OCT authority to assign tasks and optimize personnel efficiency.

WBS 1.2.1 - Identify OCT's competencies *(Completed)*

DRDC – Valcartier worked with the industry to produce a preliminary analysis detailing how assisted learning techniques could support OCT's training (Crevier, 2011). At first, efforts were invested to understand the OCT's competency. Six (6) components of competency were identified and mapped into a concept map (Figure 15). Each component is specific to an action that an OCT could perform during a TS. The developed concept map uses a graphical knowledge representation called MOT (in French, *Modélisation par objets typés*) (Paquette, 1993) that facilitates the identification, the selection and the organisation of the knowledge units needed for a given course. More details about MOT are available in the reference (Crevier, 2003).

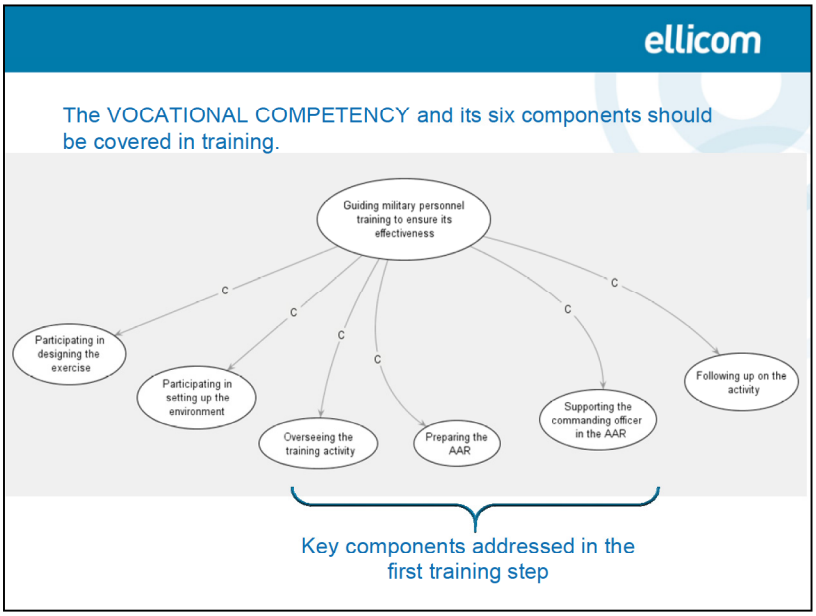


Figure 15: Concept map of the vocational competency

Among the six (6) competency components, only those usually granted to part-time OCTs were considered in this initial phase (i.e. *Overseeing the training activity*, *Preparing the AAR*, and *Supporting the commanding officer in the AAR*) (Figure 15). Other competency components are usually performed by experienced OCTs who are not our focus for this R&D activity.

Thereafter, the analysis tried to identify witch transversal competencies and skills an OCT should develop. These elements are different from specific OCT's competency components. Transversal competencies are a set of intellectual, personal, and social skills that trainees need to develop in order to engage in deeper learning. In this case, transversal competencies refer to *verbal communication*, *writing communication*, *leadership* and *teamwork*. Skills are focused on a task and refer to the application of abilities and knowledge. In this case, skills refer to *Analysis* and *Synthesis* capabilities (Figure 16).

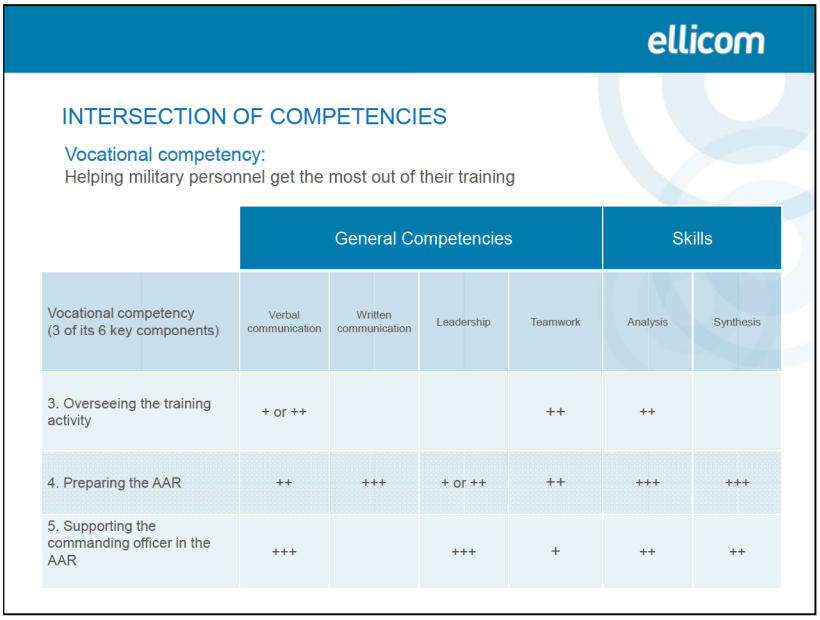


Figure 16: Intersection of competencies

In summary, the WBS 1.2.1 helps to reduce the scope of his R&D activity and suggest focusing work on three (3) circumscribed concepts that any OCTs should have or strive to develop. Concepts are:

- Competency components (3):
  - *Overseeing the training activity,*
  - *Preparing the AAR,*
  - *Supporting the commanding officer in the AAR,*
- Transversal competencies (4):
  - *Verbal communication*,
  - *Writing communication*,
  - *Leadership*,
  - *Teamwork*,
- Skills (2):
  - *Analysis*,
  - *Synthesis*.

This preliminary analysis recommended producing an architecture document analysing various implementation options such as an e-learning solution.

WBS 1.2.2 - Design and implement an interactive OCT's learning tool (Initiated)

WBS 1.2.2 provides an overview of what might look like the expected learning tool in terms of architecture, instructional techniques and cost. The design respects the three circumscribed concepts previous defined in WBS 1.2.1.

Architecture

In collaboration with the industry, *DRDC Valcartier* designed a first version of the expected learning tool architecture. The proposed architecture is divided in five (5) intertwined modules (Figure 17) described below:

- *Module 0* provides basic understanding of the OCT's role and competencies, according to the theoretical content of the official OCT training plan (ref. A-P3-003-OCT/PH-B01);
- *Module 1* provides basic understanding of transversal competencies and skills than future OCTs should develop;
- *Module 2* provides interactive learning activities raising the awareness of improving transversal competencies and skills than future OCT should have;
- *Module 3* provides interactive learning activities developing competency components previously identified;
- *Module 4* provides summative learning activities confirming the OCT vocational competency.

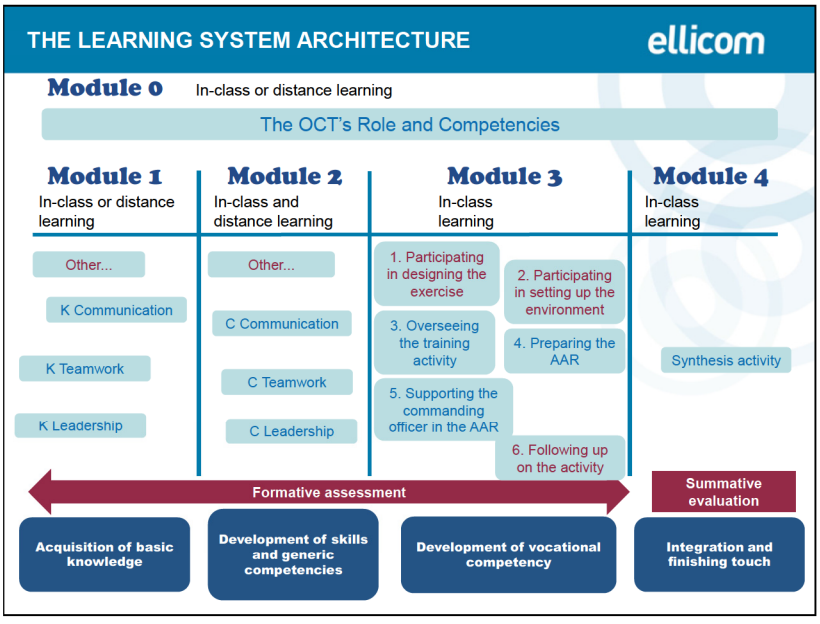


Figure 17: The learning system architecture

Instructional techniques

To achieve learning, each module requires its own instructional techniques. Figure 18 shows common examples. In general, instructional techniques are chosen according to the type knowledge to be acquired, the learner objectives, the competencies to be developed and the related costs.

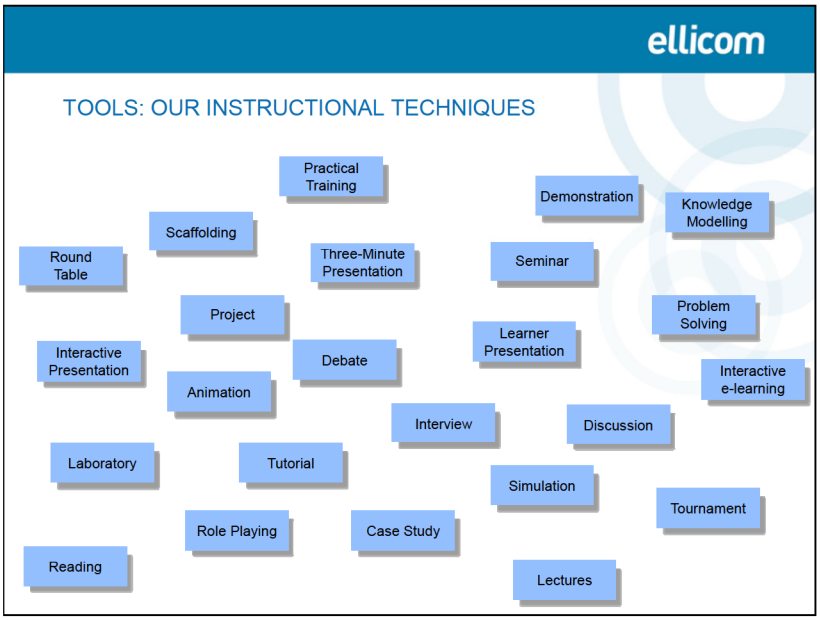


Figure 18: Popular instructional techniques

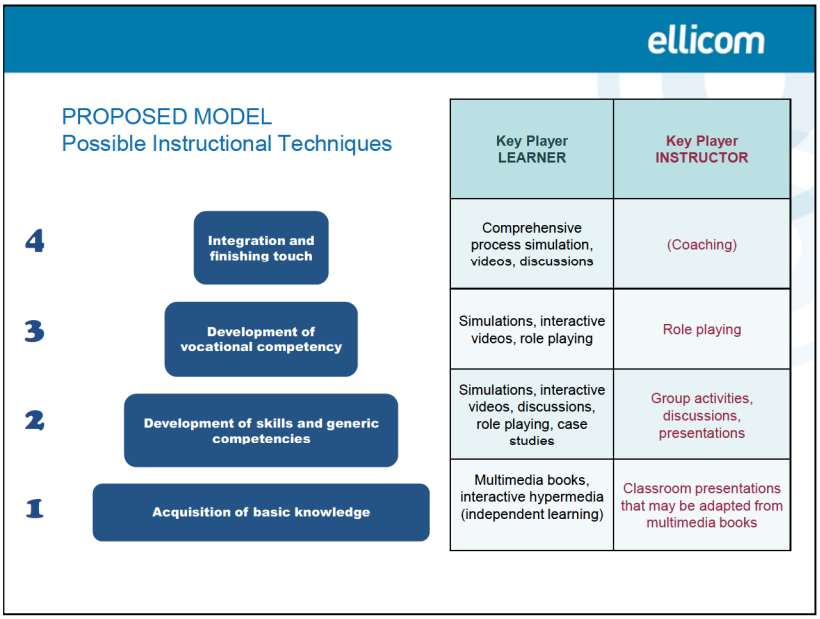


Figure 19: Possible instructional techniques (Key player: Learner versus Instructor)

For the purpose of this R&D activity, two teaching models are proposed (Figure 19). Compatible with traditional teaching methods, the first model considers the INSTRUCTOR as the principal actor of the learning process. This model relies on instructor leadership and requires less active effort from the learner. Design costs associated with this model is lower, but knowledge retention is also lower and does not last as long. For instance, the INSTRUCTOR model suggests using classroom presentations, groups activities, discussions, role playing and coaching.

The INSCTRUCTOR model should be seen as mean to accomplish more with less resource. By knowing witch competences and skills a given OCT team already master, OCT authority could optimize the assignment of critical tasks to perform before, during and after the EX. It could result in a gain of efficiency for all steps of the AAR process.

Focused on self-learning, the second model considers the LEARNER as the principal actor of the learning process. This model involves greater active learner participation, leading to higher and longer-lasting knowledge retention. For instance, the LEARNER model suggests using of multimedia books (Figure 20), simulations, interactive videos, discussions, role playing, and case studies.

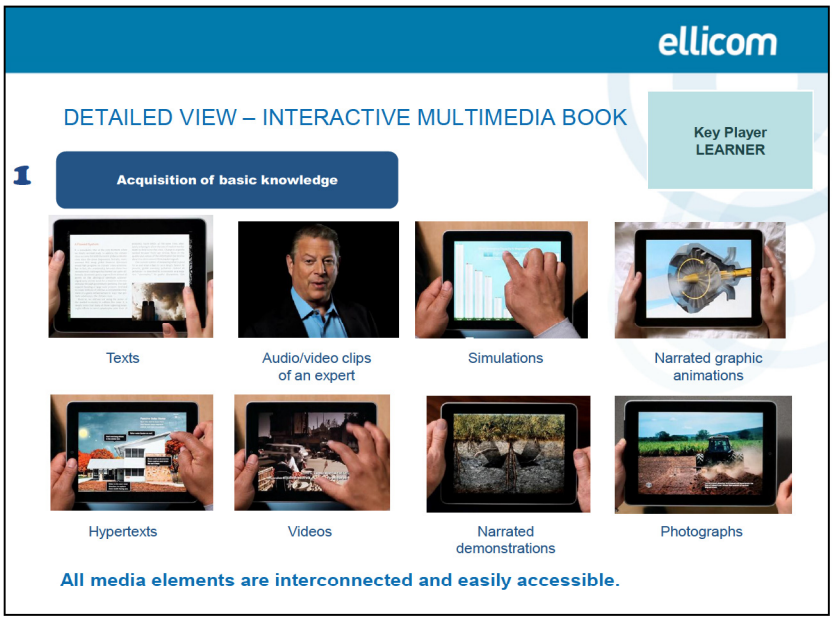


Figure 20: Instructional technique: Media book

The LEARNER model should be seen as a mean to lighten the teaching load of OCT's instructors. This model does not presume to replace traditional classroom teaching. However, a self-learning could help future OCTs to acquire a basic understanding of essential concepts prior a formal training.

Costs

Costs are complex to estimate and vary depending of the learning mode (i.e. *In-class* versus *Online*). *In-class* learning material is cheaper to develop because of the ubiquity of the instructor able to interact with the audience. Regarding *Online* learning, the teaching material should be

self-explanatory and interactive to stimulate the learning experience. The level of interactivity was categorised en three (3) levels and described below:

- ***Low interactivity:*** Similar to a linear slide presentation, the teaching material is created by using e-learning authoring tools (e.g. *elearning Maker* from *e-doceo.net*). Simple learning activities (drag-and-drop, fill-in-the-gaps …) and common multimedia content usually enhance the learning experience (Figure 21).

- ***Medium interactivity:*** Similar to a slide presentation, the learner evolves inside a virtual environment accompanied by avatars. According to the answers provided by the learner, the learning experience could not be the same (Figure 22).

- ***High interactivity:*** Similar to a video game, the learner evolves inside a serious game including simulation and/or 3D graphics. This form of interactivity is complex to develop and requires large budget (Figure 23).

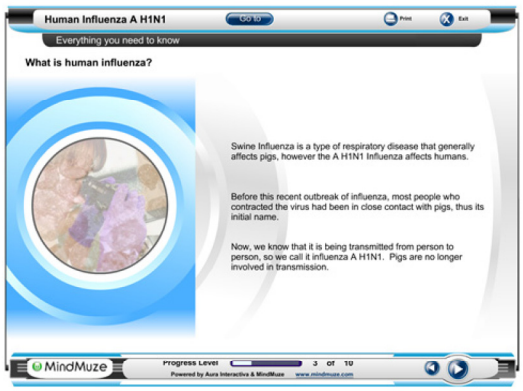


Figure 21: Example of low interactivity[6]

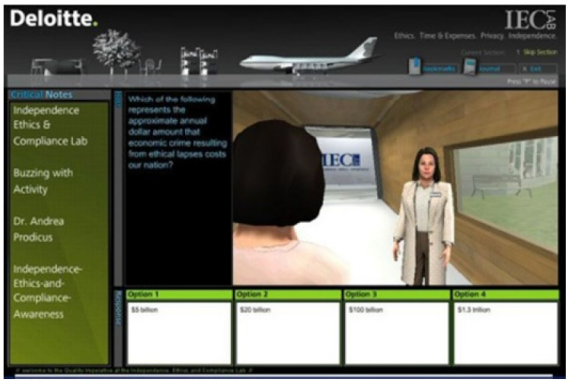


Figure 22: Example of medium interactivity[7]

Figure 23: Example of high interactivity[8]

[6] E-learning application explains what the H1N1 virus is and lists typical symptoms (MindMuze, 2009).
[7] E-learning application explains the ethical side of financial services (Paul, 2011).
[8] VBS2 is a realistic battlefield simulator that could be used for developing interactive teaching material. Figure could be retrieved into the reference (Van der Sterren, 2011).

Table 10 tries to approximate the development cost of each modules proposed by the architecture design according to the three levels of interactivity.

Table 11: WBS 1.2.2: Distribution of development costs for each module.

COST OF INSTRUCTIONAL AND MULTIMEDIA DEVELOPMENT (PRODUCTION AND INTEGRATION IN BOTH LANGUAGES)				
MODULE	LEARNING MODE	LOW INTERACTIVITY	MEDIUM INTERACTIVITY	HIGH INTERACTIVITY
(0) THE OCT, THEIR ROLE AND COMPETENCIES K - Theory (60 min.)	In-class	$15,000.00	$21,000.00	$32,000.00
	Distance (e.g. interactive book)	$20,000.00	$28,000.00	$44,000.00
(1) BASIC KNOWLEDGE K - Verbal comm. (30 min.) K - Written comm. (30 min.) K Teamwork (30 min.) K - Leadership (30 min.) C - Analysis (30 min.) C - Synthesis (30 min.)	In-class	$66,000.00	$90,000.00	$138,000.00
	Distance (e.g. interactive book)	$84,000.00	$120,000.00	$186,000.00
(2) GENERIC COMPETENCIES (INTRODUCTION) K - Verbal comm. (60 min.) K - Written comm. (60 min.) K - Teamwork (60 min.) K - Leadership (60 min.) C - Analysis (60 min.) C - Synthesis (60 min.)	In-class	$90,000.00	$126,000.00	$192,000.00
	Blended[9] (e.g. interactive book)	$84,000.00	$120,000.00	$186,000.00
(3) ROLE-SPECIFIC COMPETECY 1. Participating in designing the EX (20 min.) 2. Participating in setting up the env. (20 min.) 3. Overseeing the training activity (180 min.) 4. Preparing the AAR (180 min.) 5. Leading the AAR (180 min.) 6. Following up on the activity (20 min.)	In-class	$159,000.00	$225,000.00	$348,000.00
(4) INTEGRATION AND ALIGNMENT Synthesis activity (60 min.)	In-class	$15,000.00	$21,000.00	$32,000.00

[9] **In-class learning mode** for *Verbal communication*, *Written communication*, *Teamwork* and *Leadership,* and **Distance learning mode** for *Analysis* and *Synthesis*.

(5) EVALUATION Exam using simulations (60 min.)	In-class	$15,000.00	$21,000.00	$32,000.00

Note Table 10 does not include additional fees associated to production of bilingual material, purchase of autoring tools and implementation of the e-learning solution. Details of fees could be retreive into the client report (Crevier & Bradette, 2012).

The following step would be to develop a prototype of an e-learning tool for one of the three competency components previously identified. It is recommended to selected a low interactivity level at first in order to reduce risk associated to technological development aspects. Higher interactivity levels could be considered further after a first cycle of experiment.

Unfortunatly, the OCT's learning tool did not reach the development stage. However, this R&D activity has still had time to draft a preliminary version of a R&D contract (Annex C) aiming to among others to support the development of the OCT's learning tool. Sections C, D and E of the contract include various working task able to support a whole development process of the e-learning tool. Working tasks were defined to meet design, programming and assessment needs.

WBS 1.2.3 - Evaluate the interactive OCT's learning tool *(Not initiated)*

It would have been premature to initiate a formal assessment only after a single cycle of development. At least two cycles of development is suggested before conducting a formal experiment. Testbed sessions should be planned between each cycle of development in order to collect users' experience and to adjust following iterations of development.

This closes WBS 1.2.

WBS 1 - Summary

In summary, ASC is still strongly interested in supporting OCT's competencies development. Any further investment on both R&D activities should be done in collaboration with them. The *WBS 1.1 Optimize OCT's training schedule* should be prioritized in the case of resuming the execution of this R&D plan. The OCT training presentation development by ASC TC is ready to be formally assessed, while *WBS 1.2 Design and model an interactive OCT's learning tool* have not been developed yet.

WBS 2 - Augment OCT's capabilities

OCT's personnel exploit various stovepipe technologies to mitigate their limited situational awareness capabilities induced by the vastness of training field. To capture evidences, they use camera (picture and video) and recorder (or notepad). To synchronize their displacements among themselves to follow the training progress, they communicate by radio (often on more than one channel at the time) and cell phones. When available, they exploit the CWES system to understand TS progression Figure 24. At last, to conduct AAR session, they use *Microsoft Office* suite to present their observed evidences.

Figure 24: An OCT evaluates tactics during EX MAPLE RESOLVE 2013[10].

Some OCT personnel have integrated the use of a smart phone within their activities. They could benefit of many advantages on a unique device, such as taking pictures and videos, sharing information, consulting local map, referring manual procedures, recording personal notes and so on... Up to now the smart phone is use on an individual basis.

This chapter presents two R&D activities aiming to explore the benefits of using mobile devices for OCT's duties. Firstly, the R&D plan suggests assessing the potential of current mobile accessories and apps offered by the market (WBS 2.1) for capturing evidences on the field. Secondly, the R&D plan grabs the opportunity to extend the use of mobile devices to start thinking about digitalizing the AAR process (WBS 2.2) for lightening the workload associated to the application and the management of the AAR process. Both target productivity gains by automatizing subtasks of the AAR process. In a long term, we hope these R&D activities will contribute to provide relevant indicators to regulate the use of mobile devices for OCT.

[10] (World Armies, 2013).

WBS 2.1 - Explore smartphone devices capabilities for OCTs

This R&D activity is composed of three (3) WBS elements where each of them has been initiated but still uncompleted because of the project termination (Table 12). Level of completeness of each WBS is detailed under.

Table 12: Summary of WBS 2.1. "Explore smartphone devices capabilities for OCTs"

R&D Activity	Explore smartphone devices capabilities for OCTs
Expected outcome(s)	Augment OCT's capabilities
Main issue addressed	**D. OCT personnel use stovepipe technologies to capture evidences that overload their duties**
WBS elements	2.1.1 Identify relevant mobile device accessories and apps *(Initiated)* 2.1.2 Evaluate benefits of mobile devices *(Initiated)*
Progression status	**Initiated.**
Involved organisations	**Leader**: DRDC-Valcartier **SME**: LFQA TC

Today, common mobile device capabilities are well known (Apple, 2013) (Wikipedia.org, 2013a). Instead of focusing on the mobile device itself, this activity wants to identify accessories and apps that could extend capabilities of mobile devices in order to support OCT on the field. The *iPhone 4S*[11] (Wikipedia.org, 2013b) has been selected as the reference model. The ubiquity of *iPhone* gives it a strong market attention. In addition, its size was judged more convenient for outside duties as opposed to the *iPad* size.

[11] The *iPhone 4S* was the latest model available at the time of the study.

WBS 2.1.1 - Identify relevant mobile device accessories and apps (Initiated)

The first part of WBS 2.1.1 tried to identify relevant mobile device accessories for OCT's duties. The accessory market offer is larger for *iPhone* then for other mobile devices. Some accessories seem to have an extend market life due to the fact that *iPhone* cases still almost similar over the years (Figure 25).

Figure 25: iPhone Product Timeline – All Things D (Paczkowski, 2012)

Eight (8) accessories were retained by this preliminary analysis. The selection of these accessories was based on the subjective reviews done by various web TI experts. Retained accessories are presented from Table 13 to Table 20.

Table 13: iPhone 4S accessory – Buddy's Keyboard for iPhone 4S – Backlit Edition

 Figure 26: Buddy's Keyboard for iPhone 4S – BoxeWave	**Buddy's Keyboard for iPhone 4S – Backlit Edition** *by BoxeWave.com* The *Buddy's Keyboard* is a complement to the iPhone's on-screen keyboard. The iPhone's touch screen keyboard disappears when the *Buddy's keyboard* is slid out. Thereby, more space is available to display content. This accessory is paired through Bluetooth 2.0 with the iPhone and provides a secure snap on shell. An onboard battery, chargeable by micro-USB cable, provide two week duration of charge. The backlit key feature simplifies is use both day and night (BoxeWave, 2013). Range price: ~$70 CDN. Reviewed by ilounge.com (Horwitz, 2011).

Table 14: iPhone 4S accessory – Dial Lens for iPhone 4S

 Figure 27: Dial Lens for iPhone 4S – Photojojo	**Dial Lens for iPhone 4S** *by Photojojo.com* The *Dial Lens* extends the capabilities of the iPhone camera. It proposes three optical-quality glass lenses: • The 0.7x wide-angle lens increase the field-of view for broad landscapes, • The 0.33x fisheye lens captures 180 degree field-of-view images, • The 1.5x telephoto lens provides images closer of your subject. Lens are wrapped into a rotate disk mounted on an aluminum shell (Photojojo, 2011). Range Price: ~$250 CDN Reviewed by 9to5mac.com (Betters, 2012).

Table 15: iPhone 4S accessory – Night Vision Scope AN/PVS-14A for iPhone 4S

 Figure 28: Night Vision Scope AN/PVS-14A for iPhone 4S – US Night Vision Corporation	**Night Vision Scope AN/PVS-14A for iPhone 4S** *by USNightVision.com* The AN/PVS-14A night vision scope is the standard issue night vision device for US military forces and special-ops teams. The night vision scope comes with a iPhone adapter kit that adds 8 megapixel digital recording, zoom and image stabilization, time-stamping and geo-tag capabilities to the system (Night Vision Experts, 2011). Range price: ~$4000 CDN (including the iPhone adapter). Reviewed by defensereview.com (Crane, 2012).

Table 16: iPhone 4S accessory – Pico projector MobileCinema i50S for iPhone 4S

 Figure 29: Pico projector MobileCinema i50S for iPhone 4S – Aiptek	**Pico projector MobileCinema i50S for iPhone 4S** *by Aiptek.com.tw* The *MobileCinema i50S* for iPhone 4S employs DLP technology with 35 ANSI lumens brightness that providing a VGA projection image quality (480x640). This pico projector represents a cheap option for group projection sessions. With the embedded 1850mAh rechargeable battery, it could make 120 minutes projection (AIPTEK International Inc., 2012). Range price: ~$300 $ CDN Reviewed by TrustedReviews.com (Chester, 2012)

Table 17: Smartphone accessory – PoiseCam iPhone Camera Grip

 Figure 30: *PoiseCam* for iPhone – PoiseCam LLC	**PoiseCam iPhone Camera Grip** *by PoiseCam.com* The *PoiseCam* is a iPhone camera grip that reduces arm and hand fatigue while shooting (PoiseCam LLC, 2013). Range price: Not sell yet.

Table 18: iPhone 4S accessory – Spot connect for mobile devices

 Figure 31: Spot Connect for mobile devices – Spot LLC	**Spot connect for mobile devices** *by Spot LLC (findmespot.ca).* *Spot Connect* connects your smartphone to a global satellite network when you go beyond the reach of grid. This device allows the iPhone to send email, text messages and GPS coordinates. It can be used for broadcasting your status even on Twitter and Facebook (SPOT LLC, 2013). Range price: ~$170 CDN for hardware + ~$100 CDN/year for a satellite network access subscript. Reviewed by WillGadd.com (Gadd, 2011).

Table 19: iPhone 4S accessory – Mophie Juice Pack Pro for iPhone 4S – Outdoor Edition

 Figure 32: Mophie Juice Pack Pro for iPhone 4S Outdoor Edition – Mophie	**Mophie Juice Pack Pro for iPhone 4S – Outdoor Edition** *by Mophie.com* The *Mophie Juice Pack Pro* extends the iPhone battery by 150%. Its ruggedize version protects the iPhone from rain, sand and impact. It has been tested to exceed the standards for impact protection and dust/sand penetration set forth by the United States Military (MIL-STD 810G) (mophie, 2013). Range price: ~$150 CDN Reviewed by iSource.com (Rogers, 2011).

Table 20: iPhone 4S accessory – AR.Drone 2.0 for iPhone 4S

 Figure 33: AR.Drone 2.0 for iPhone 4S – Parrot	**AR.Drone 2.0 for iPhone 4S** *by Parrot.com* The *AR.Drone 2.0* is remote-controlled by an iPhone or iPad and features a number of sensors, including a high-definition front camera, vertical camera, an ultrasound altimeter and absolute control mode. With the AR.Drone 2.0, you can record video and take pictures while in-flight (Apple Store (Canada), 2013) (Parrot, 2012). Range price: ~$300 $ CDN Reviewed by Gizmodo.com (Johnson, 2012).

Except for the *Night Vision Scope* (Table 15), the cost of accessories are quite affordable (i.e. from 100$ to 300$).

Table 21 summaries expected benefits of each accessory for OCT's duties.

Table 21: iPhone 4S accessories – Potential benefits for OCT's personnel

Mobile device accessories	***Potential for benefits for OCT's personnel***
Buddy's Keyboard	*Accelerate note-taking*
Dial Lens	*Extend camera capability (i.e. zoom and angle of view)*
Night Vision Scope AN/PVS-14A	*Extend camera capability (i.e. night vision)*
Pico projector MobileCinema i50S	*Allow informal group projection session*
Mophie Juice Pack Pro	*Protect the mobile device from outside hazards & extend its battery life*
Spot connect	*Use global satellite network when 3G or WAN networks are not available*
PoiseCam Grip	*Reduce arm and hand fatigue while recording or taking pictures*
AR.Drone 2.0	*Add the capability to record video and take picture in-flight*

Many accessories cannot be used simultaneously because they are designed to clip on the *iPhone*. This limitation may affect OCT's focus during a TS if an accessory shift is required. At last, users should be aware that the use of some accessories may increase the energy consumption, and thereby reduce the battery life.

Several *iPhone* accessories (i.e. a set of lens, a pico projector, a battery case and a global satellite network add-on) were purchased before shutting down the project. These accessories are available if CMTC or LFQA TC wishes to resume this R&D initiative.

The second part of WBS 2.2.1 aims to identify relevant mobile application for OCT's duties. Due to the huge market offer, it is obvious to note that conducting a mobile applications review is much more challenging than the previous one focused on accessories. Fortunately, there exist many subjective reviews on the web trying to identify the most convenient software for various categories of tasks. But, this second part has not been initiated.

WBS 2.1.2 - Evaluate benefits of mobile devices *(Initiated)*

WBS 2.1.2 aims to conduct an experiment in order to formally assess the *iPhone* configuration (including accessories and apps) during a live TS. Discussion with LFQA was initiated in order to identify formal EXs for experiments. These discussions leaded to a formal agreement between both parties that grant accessibility to real training sessions for the AAAR project. *EX Réaction Royale 2013* was identified to support this experiment. Details of the agreement are available at Annex A.

In preparation to the *Réaction Royale EX*, the *Gaming and Emerging Technologies Laboratory (GET Lab)* (Annex B.1) was used for supporting configuration efforts and testing the mobile device. The *GET Lab* was created in 2010 to explore potential of mobile devices, e-learning, serious gaming and virtual training systems for FC. The lab has the capability to support mobile device application development and experiment with wireless technologies. The lab is located in DRDC – Valcartier. It includes workstations (10) and wireless devices (5) for mobile development, game-based training exploration, visualization hardware demonstrations, etc. Mobile devices using Wi-Fi and 3G could be used under specific security regulations managed by DRDC – Valcartier. Owned mobile devices include: *iPhone 4S* (Figure 34), *iPad*, *iPad 2* (Figure 35), *Samsung Galaxy Tab 7* and Samsung Galaxy Tab2 10.1 (Figure 36).

Figure 34: iPhone 4S – Apple

Figure 35: iPad 2 – Apple

Figure 36: Galaxy tab2 10.1 – Samsung

At last, the GET Lab software environment includes:

a. *IOS* and *Android* development workstations;
b. An e-learning development suite to create web-based learning activities;
c. JCATS (Joint Conflict and Tactical Simulation) workstations for constructive military operations simulation;
d. VBS2 workstations for virtual military simulation.

Unfortunately, due to the termination of the project, configuration and testing efforts were not completed. Even if the experiment should have been cancelled, LFQA TC reiterated their support for future experiments. Obviously, this report could not formulate any recommendations to time.

However, LFQA TC contributor and report authors continue to believe that mobile devices could contribute to support evidence captures during live training. Therefore, it is suggested to pursue this R&D initiative locally if possible. This closes WBS 2.1.

WBS 2.2 - Digitalize and virtualize the AAR process

This R&D activity stills at the proposal stage. It is composed of three (3) WBS elements where no one has been initiated (Table 22). This R&D activity proposal should be presented to CMTC and ALLC authorities in order to assess their interest.

Table 22: Summary of WBS 2.2 "Digitalize and virtualize the AAR process"

R&D Activity	***4. Digitalize and virtualize the* AAR process**
Expected outcome(s)	Augment OCT's capabilities
Main issue addressed	***F. Little time is allowed to produce content of AAR session*** ***H. Follow-up reports stay unused***
WBS elements	2.2.1 Pursue the current digitalization initiative *(not initiated)* 2.2.2 Initiate the virtualization of the AAR process *(not initiated)* 2.2.3 Initiate reflections about specific visualization *(not initiated)*
Progression status	***Still at a proposal stage***
Involved organisations	***Leader**: TBD*

The ALLC has initiated the digitalization of the AAR process by making available, through its website (ALLC / CLRA, 2012a), several course packages, doctrine manuals, forms and presentations covering each aspect of the process itself and the OCT's duties. This initiative encourages the Army to collect, analyze, assimilate and distribute experiences as lessons. Unfortunately, numerous of AAR sessions stay informal and do not generate any follow-up report because of the workload required to produce it. It results in a loss of knowledge where costly errors could happen again.

This R&D activity is complementary to the previous one regarding the identification of suitable mobile applications for OCT duties. It suggests exploiting mobile devices not only to capture evidences, but for all steps of the AAR process. The following WBS presents how virtualization could help OCT personnel to reduce the workload associate to the application of the AAR process.

WBS 2.2.1 - Pursue the current digitalization initiative *(not initiated)*

WBS 2.2.1 suggests pursuing the current digitalization initiative while by introducing "mobile" versions. The intended effect is to encourage digital note taking habit, even in the field. Once data is in digital format, it becomes easier to share it and reuse it for subsequent phases (or sub-phases) of the AAR process, such as the *Conduct* or *Follow-Up* phases. In addition, this first improvement step should include efforts to develop intertwined links between documents, especially for forms, in order to avoid redundant information entries. Prefilled forms based on previous entries, predefined fields and auto-completion fields have the potential to reduce typo errors and save time required to generate the final follow-up report for instance.

WBS 2.2.2 - Initiate the virtualization of the AAR process *(not initiated)*

WBS 2.2.2 consists to initiate the virtualization of the AAR process by adding a shared storage capability to the mobile one (i.e. private cloud storage). The intent is to increase the data accessibility as well for the OCT personnel as for the training audience. In one hand, OCT personnel could benefit of virtualization by simplifying their tasks related to centralize, merge and consolidate data gathered during exercises. In the other hand, training audience could benefit of virtualization by accessing the content of the conduct session and the follow-up report provided by OCT personnel. Of course, several software services should support this step in order to ensure data integrity, security and accessibility functionalities.

The virtualization of the AAR process allows considering new analysis opportunities of training audiences. It would be interesting to explore how gathered data by OCT over many TS might be exploited to assist CA planning for instance.

WBS 2.2.3 - Initiate reflections about specific visualization *(not initiated)*

The context of conducting an AAR session may be very different one to another. Some are informal and conducted right after TS, while others are prepared and presented in front of a large audience. Some focus on a man squad operation, while others consider a daylong of mixed exercises done by a brigade. Some focus on speciality skills, such as medic, while others evaluate the overall performance of a group.

Up to now, only the generic use of documents mentioned above for supporting the AAR process was considered. The last step is to initiate reflections about specific visualization requirements depending of the type (LVC), the scope (from individual to collective), the audience (intelligence, artillery, medics, supports ...), and the intent of the training. This complex step should offer to the OCT personnel the capability to obtain flexible and on-demand user interfaces that fit with its current needs. This step could get inspired by numerous video games and application interfaces designed for tablet devices. Some of these have developed esthetical graphics interfaces able to manage outstanding representations for large datasets.

This closes WBS 2.2.

WBS 2 - Summary

In summary, LFQA TC is still strongly interested in augmenting OCT's capabilities by exploring mobile devices and by virtualizing the AAR process. To pursue the work, this report suggests completing WBS 2.1 (i.e. Explore smartphone devices capabilities for OCTs) before to initiate WBS 2.2 (i.e. Digitalize and virtualize the AAR process). We believe that WBS 2.1 results (those related to the identification of mobile application for OCT) could leverage WBS 2.2 efforts. We expect that identified app in WBS 2.1 could be exploited by WBS 2.2.

WBS 3 - Explore innovative ways to present evidence

Besides taking notes or exchanging key information among themselves, OCTs usually take pictures and record videos of TS. These evidences of training actions are fundamental to justify their observations and gain the respect of the training audience during the *Conduct* phase.

Current simulator systems, such as VBS2 or JCATS (supported by Aramis) are able to generate snapshots or audio/video recordings. Here, OCT personnel have the opportunity to replay the mission and have the capability to add complementary data (such as geo referential positions, unit names, life status, line of shot...) over the evidences to strengthen their observations. The challenge here is not about getting access to the data, but more about figuring out what is the best visualization representation to present the evidence.

Figure 37: An OCT uses VBS2 to present training evidences at ASC.

According to OCT experts, discussion topics brought to AAR sessions are often the same. OCT personnel could benefit to use predefined visualization templates dedicated to support these recurring topics. The community of *Visual Analytics* (Vande Moere, 2013) presents inspiring examples having the potential to enable the viewer to understand the information. This improvement could reduce time to prepare clear evidences.

WBS 3.1 - Enhance AAR visualization

This R&D activity is composed of three (3) WBS elements where each of them were completed (Table 23).

Table 23: Summary of WBS 3.1"Enhance AAR visualization"

R&D Activity	***Enhance AAR visualization***
Expected outcome(s)	*Explore innovative ways to present evidences*
Main issue addressed	***E. AAR systems provide raw data complex to exploit***
WBS elements	1.1.1 Assess current AAR systems *(Completed)* 1.1.2 Explore potential of video-game-based visualization *(Completed)* 1.1.3 Explore potential of Augmented reality visualization *(Completed)*
Status	***Completed.*** *But results were not presented to CMTC authority.*
Involved organisation(s)	***Leader****: DRDC-Valcartier*

After TSs, OCT personnel must prepare the AAR session by identifying relevant topics for discussion. When available, OCTs use *CWES*, *VBS2* or *Aramis* replays to create multimedia content, and prepare maps, graphs, charts, pictures, videos and references to support discussion topics. Usually, the created content is inserted into a slide presentation that respects an outline suggested by best practices.

WBS 3.1.1 - Assess current AAR systems *(Completed)*

Over the years, CA has dealt with numerous visualization softwares producing similar renderings (Figure 38 to Figure 43) to replay TS. Five systems have been identified where two types of views are used for representing the progression of the units on the field. The Map view is proposed by each visualization tools while 3D view is only possible with *VBS2* and *FalconView*.

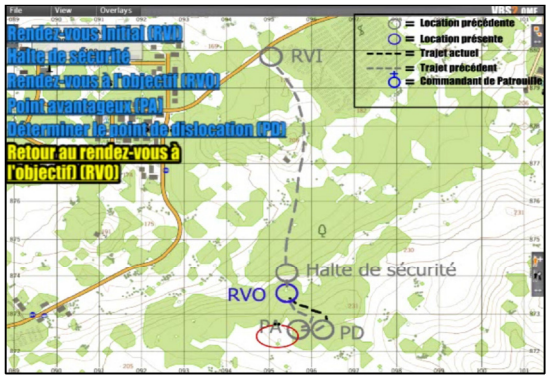


Figure 38: AAR system - VBS2 - Map view

Figure 39: AAR system - VBS2 – 3D view

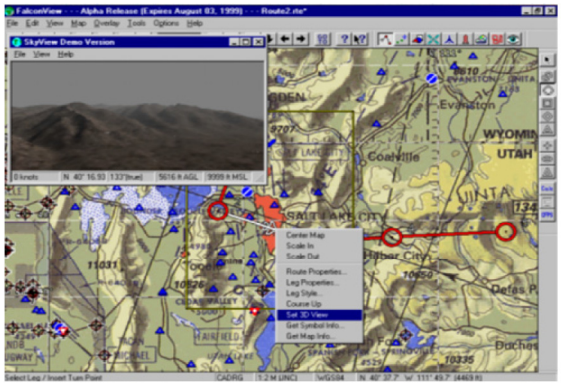


Figure 40: AAR system - FalconView

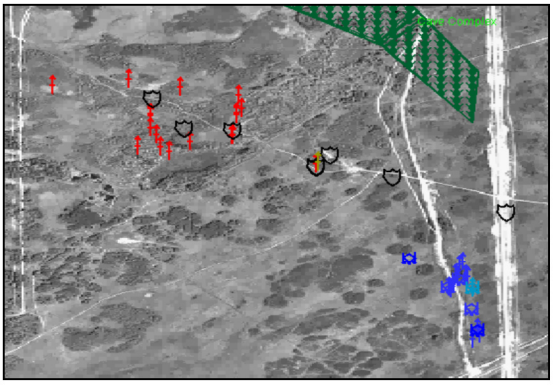


Figure 41: AAR system - CWES

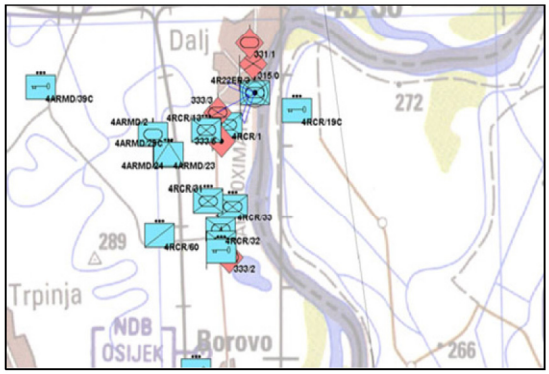


Figure 42: AAR system - Aramis

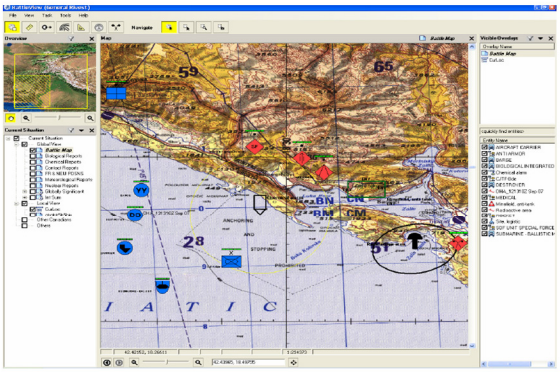


Figure 43: AAR system – Battleview

WBS 3.1.1 presents a list of suggested improvements for AAR visualization systems. Four (4) points of discussion were captured during events held to gather client needs (Table 1). These suggestions will be forwarded to the *Direction of Combat Support Equipment Management* (DCSEM) of CAF in order to guide any future requirement definition activities aiming to update AAR visualization systems of CAF.

Reduce number of visualisation products

Each of these AAR visualization products has similar functionalities able to display military manoeuvres read from a live or an offline data stream. Clearly, there exists an overlap in term of functionalities. Therefore, this report recommends assessing the possibility to reduce the number of visualization products, in order to optimize fees associate to licensing and maintenance. Workshop sessions should be held to determine which visualization products should be kept, updated and discarded.

Modernize visualization techniques

Our preliminary analysis wishes to raise concerns about visualization systems that do not meet modern GUI (Microsoft Corporation, 2010) and map interaction design (Little, 2013). For instance, some AAR visualization systems (such as CWES) use unstandardized icons to represent military units. These AAR systems should adopt the NATO Military Symbols for Land Based standard (Wikipedia.org, 2013c) in order to standardize representations. Also, recent AAR systems should get inspired by the video game industry in order to propose modern icon mapping technics that avoid overlapping rendering. A review of this domain should be done in order to solve this issue. At last, modern geospatial views should adopt vector map representations that allowing fine zooming.

Develop mobile versions

Similar of WBS 2 recommendations, our preliminary analysis suggests bringing AAAR system views on mobile devices. OCTs could follow in real-time any TS monitored by the CWES core (Figure 44). This enhancement could help OCTs to control the evolution of TS. Sometimes according to the training audience displacement on the field, OCTs have to adjust the execution of the scenario. Mobile views could help OCTs to deal with this kind of issues.

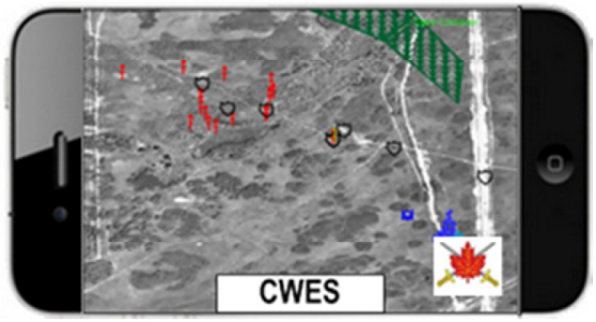


Figure 44: CWES for iPhone – Fictional version.

Improve interoperability of AAR systems

According to *Wikipedia.org*, the term interoperability is used for describing the capability of different programs to exchange data via a common set of exchange formats, to read and write the

same file formats, and to use the same protocols (Wikipedia.org, 2013d). More interoperability for AAR systems could open many opportunities serving as well the training authority than the scientific domain. For instance, interoperability could allow commercial products, such as Tableau (Tableau Software, 2013), to offer innovative ways to display and analyse recorded data. Also, it could help to bring captured data streams into CA simulation tools, such as VBS2 and JCATS, for supporting blended TS styles.

Future AAR system should publish theirs software interfaces to help CA software communicating together. Open interfaces would reduce soul source contracting and stimulate industry to develop innovative training products.

WBS 3.1.2 - Explore potential of video-game-based visualization *(Completed)*

The goal of WBS 3.1.2 was to identify a low-cost technology able to generate 3D rendering of TS captured by CWES. OCT personnel wished to evaluate if 3D views could be more efficient to present training evidence than using 2D views.

Because this R&D initiative was realized prior the official acquisition of VBS2 by CA, the adaptation of real-time strategic *video games* (VG), such as *Company of Heroes* (Figure 45) or *World in Conflict* (Figure 46) appeared as a valid option at that time. Today, VBS2 would be preferred to fulfill this objective. VBS2 has a powerful *Software Development Kit* (SDK) module and an advanced scripting language that would have the capability to interpret the content of CWES logs.

Figure 45: Company of Heroes – Art box[12]

Figure 46: World in Conflict – Art box[13]

The adaptation of a VG platform, also known as modding, is an effective approach to support fast application prototyping for R&D purposes. This kind of approach appears to be an efficient and affordable option to satisfy project objectives inspired by VG orientations. However, many challenges await non initiated R&D teams to modding. The understanding of modding theory, the identification of the "best" platform, the estimate of development efforts and, the technical capabilities of the project team are some factors that could threaten the success of such a project. More on modding could be read here (Boivin, Bernier, & Bouchard, 2012).

WBS 3.1.2 has been done by *Hexasys inc*. through the contract number DRDC-RDDC W7701-12566. A client-server approach was developed for demonstrating the concept. CWES log entries were emulated by sending commands from the *control computer* to the *game computer*. Thereafter, commands received by the *game computer* were converted into virtual keyboard strokes recognized by the VG. Figure 47 shows the developed strategy to send command to the VG.

[12] See (Wikipedia.org, 2013e) for a complete descriptive of the VG *Company of Heroes*.
[13] See (Wikipedia.org, 2013f) for a complete descriptive of the VG *World in Conflict*.

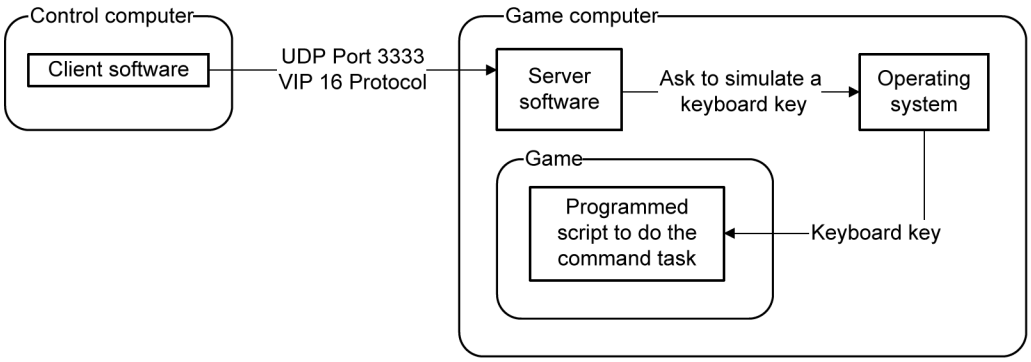


Figure 47: Flow diagram used for sending command to game

Both VGs were modified in order to recognized commands sent by the *control computer*. Table 24 lists possible modding opportunities that could be applied during a session. Note that Table 24 is not an exhaustive list. Some modding opportunities may not have been inventoried.

Table 24: Online modding – Possible in-game triggers

Modding opportunities (Online)	***Company of Heroes***	***World in Conflict***
Control of units		
• Deploy units and groups at location	x	x
• Order units to move/attack/stop/enter building		x
• Order units to get into a specific formation		x
• Damage/Heal units and buildings		x
Adaptation of gameplay		
• Gives action and experience points to player	x	x
• Toggle AI On/Off	x	x
• Change game speed	x	x
Adaptation of content		
• Change atmosphere (Fog / daylight / …)	x	x
Adaptation of GUI / HUD		
• Display text	x	x
• Hide status menu	x	
• Toggle GUI On/Off		x
• Fade to black/Fade to game		x
• Reveal/Hide part of the world		x
Control of the camera		
• Move and point the camera at location/object		x
• Shake camera		x

Figure 48 to Figure 50 show two (2) examples of command triggered online. Daylight conditions were changed for a darker sky and tanks were spawned.

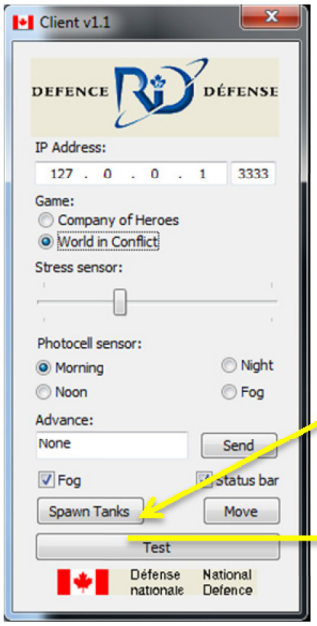


Figure 49: Control computer - Client software

Figure 48: Game computer – World in Conflict VG – Original view

Figure 50: Game computer – World in Conflict VG – Spawned tanks and sky changes

In addition, *Hexasys* demonstrated it was possible to create or modify VGs scenarios prior its execution. Supported by the VG community, several modding tools are offered to adapt maps, 3d models, unit behaviors and GUI. Table 25 lists modding tools for both VGs. Note that some modding tools may not have been inventoried.

Table 25: Offline modding – Tools

Possible Modifications (Offline)	***Tools***	
	Company of Heroes[14]	***World in Conflict***[15]
Level editors (ex.: level, terrain, environment …)	*World Builder*	*WiCEd*
Content editor (ex.: texture, name, color, …)	*Corsix's - Mod Studio*	*Showbox*
Behaviour editor (ex.: units, buildings and game properties)	*Action Editor*	*Digital Juice Editor*
Menu and in-game GUI	*[empty]*	*GUI Editor*

[14] See http://forums.relicnews.com/ for more details about *Company of Heores* modding tools.
[15] See http://wiki.massgate.net for more details about *World in Conflict* modding tools.

Figure 51 to Figure 53 show a texture change applied prior the execution of the scenario. The flag of the barrack was replaced by a Canadian one by using *Photoshop* (Adobe, 2013) and *Corsix's Mod Studio* (Corsix.org, 2008) (Figure 52).

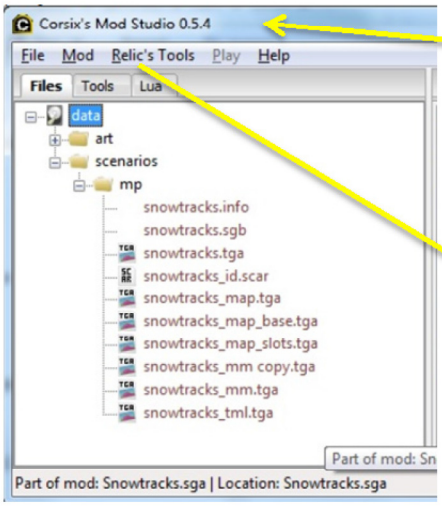


Figure 52: Corsix's Mod Studio[16]

Figure 51: Game computer – Company of heroes – Original view

Figure 53: Game computer – Company of Heroes – Texture modding

Despite the presence of a capacity to change the graphical aspects of military units to FC context, the absence of a geo-referenced positioning mechanism induces variability in unit moving sequences. Therefore, the two (2) VG titles failed to demonstrate satisfactorily that the proposed concept is viable. Fortunately, VBS2 supports geo-referenced positioning and appears as logical choice to pursue this R&D initiative of providing 3D view to training audience for live TS.

[16] Screenshot extracted from http://forums.relicnews.com.

WBS 3.1.3 - Explore potential of Augmented reality visualization (Completed)

With their camera and touch display, smart devices open widely the door to *Augmented Reality* (AR). AR superimposes a computer-generated image on a user's view of the world, thus providing a composite view. Numerous examples demonstrate the large potential that could offer the combination of databases, live tracking system and/or computer vision algorithms with smart devices (Cook, 2010) (iPhoneNess, 2010). For OCT personnel, it could open the way to new observation capabilities such as identifying units on the field (i.e. trainees, OCT personnel, vehicles, enemies, building, road ...), consulting information associated to these units, (i.e. health status, functions, location log, communication log ...), attaching personnel data (i.e. notes, time markers, videos ...), and even projecting actions or results by using artificial intelligence algorithms. The potential of AR applications for OCT personnel is very large and stay to be defined.

The aim of WBS 3.1.3 was to explore if any trainees' information could be superimposed on video feed captured during a training session in order to support observing activities of OCT personnel. Therefore, two (2) applications were developed for demonstrating the concept. WBS 3.1.3 has been done by *CIMMI (Centre en imagerie numérique et médias interactifs)* through the contract number DRDC-RDDC W7701-16573 and the mutual collaborative research agreement SRE-11-067 (DRDC Valcartier & CIMMI, 2011).

Figure 54 and Figure 55 show the first AR application developed by the CIMMI. A video camera, fixed at the top of the TV, tracks a target held by the user. When the target is detected, the application superimposes a 3D model of a military vehicle over the video feed. Within the limits of the field of view of the camera, the user can move and rotate the target in order to visualize all sides of the 3D model.

Figure 54: Augmented Reality – TV based prototype – View 1

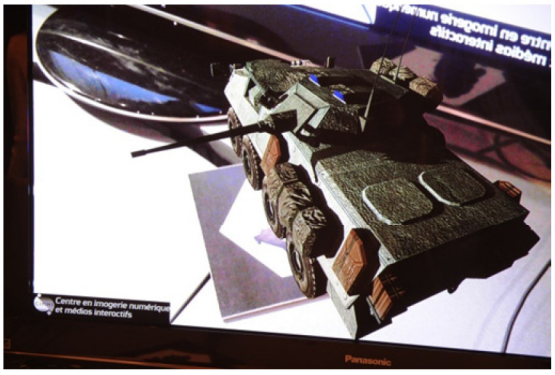


Figure 55: Augmented Reality – TV based prototype – View 2

Figure 56 and Figure 57 show the second application developed by the CIMMI. The AR application has been adapted for a mobile device (i.e. an iPad 2). With its embedded camera the mobile device can track a target placed on a table. Unlike the first prototype, the target stills immobile and the user can move around the target to visualize the 3D model displayed on the mobile device screen. The application includes a convoy scenario where several pop up views can

be enabled. For the purpose of the scenario, these views emulate hypothetic urban cameras positioned in the virtual environment.

Figure 56: Augmented Reality – iPad based prototype – View 1

Figure 57: Augmented reality – iPad based prototype – View 2

WBS 3.1.3 demonstrates that the concept of AR is progressing, but it is not ready to be exploited by OCT personnel on the field. OCT authority should watch future technological developments that could allow future AR systems to detect uniqueness of trainee without using any target. WBS 3.1.3 suggests to follow the human recognition domain that could enabled the continuation of the development of the expected AR application.

This closes WBS 3.1.

WBS 3.2 - Provide innovative state reviews

This R&D activity stills at the proposal stage. It is composed of two (2) WBS elements where no one has been initiated (Table 26). This R&D activity proposal should be presented to CMTC and ALLC authorities in order to assess their interest.

Table 26: Summary of WBS 3.2. "Provide innovative state reviews"

R&D Activity	***6. Provide innovative state reviews***
Expected outcome(s)	*Explore innovative ways to present evidences*
Main issue addressed	***G. Trainees admit their mistake only if they see it***
WBS elements	*3.2.1 Explore the concept bio sensing for LVC training (not initiated)* *3.2.2 Develop physiological / psychological state review for AAR session (not initiated)*
Status	***Not initiated.***
Involved organisation(s)	***Leader**: DRDC-Valcartier*

Future training systems look for adding biometrics sensors and affective dimension to exercises. These new training opportunities, based on human behaviours, are inspired from emergent gameplay styles coming from the video game industry (i.e. *adaptive gaming*[17], *biofeedback gaming*[18] and *affective gaming*[19]). Thereby, future AAR session could benefit of these new data sets in order to provide physiological and psychological states review of the training audience.

Figure 58: SMT project – Virtual training session

Figure 59: SMT project – Live training session at CFMedical Simulation Centre.

[17] An adaptive game provides a more appropriate level of challenge, smooth the learning curve, and enhance the gameplay experience for players regardless of experience (Charles et al., 2005).
[18] A biofeedback game exploits player's biometrics measurements to modify the gameplay experience (Nacke, Kalyn, Lough, & Mandryk, 2011).
[19] An affective game supports the recognition and expression of user and game character emotions (Hudlicka, 2009).

The concept of exploiting biometric measurements to support training activities is not new (Nacke, Kalyn, Lough, & Mandryk, 2011). This concept was recently applied to a military context by the *Stress Management Training* (SMT) project (Francois Bernier, Boivin, & Bouchard, 2012) conducted by DRDC Valcartier (Figure 58 and Figure 59).

The project successfully demonstrates that emotional response of trainees could be exploited to maximize efficiency of training activities. During a virtual training session, biometric measurements are used for adjusting the level of difficulty of a military mission. Biometric measurements are recorded by using a wireless transmitter belt that captured *heart rate* (HR) and *galvanic skin response* (GSR). Thereafter, biometric measurements are mathematically merged to compute the trainee stress level. If the trainee succeeds to manage his level of stress by using a breathing technic previously taught, he maximizes his chance of completing the mission. If not, skills of his opponent become stronger and threaten his chance to finish his mission.

WBS 3.2.1 - Explore the concept bio sensing for LVC training *(not initiated)*

Whereas it is possible to determine the human behavior (i.e. stress level) with biometric sensors, this R&D activity suggests exploring the opportunity of adding physiological or psychological state review to AAR session. As first step, the R&D plan proposes to investigate if software training systems, such as VBS2, JCATS or JSAF, could be adapted to conduct the initial exploration in a controlled environment. Many of these systems are flexible enough to integrate biometrics sensors.

WBS 3.2.2 - Develop physiological / psychological state review for AAR session *(not initiated)*

WBS 3.2.2 should focus on how to exploit and presents biometrics measurements to the training audience during an AAR session. Many questions related to format and graphical aspects will lead this last step. Unfortunately, WBS 3.2 still at the proposal stage. It should be presented to the CMTC authority in order to assess their interest.

This closes WBS 3.2.

WBS 3 - Summary

Despite the fact that virtual and live training systems have powerful monitoring capabilities, training community struggles to exploit the potential of this valuable information to reveal trainees' performance. WBS 3 tries to answer to this fact by presenting R&D activities mainly driven by a technological focus.

Several R&D options were explored. At this point, OCT's authority opinion is essential to rule on following steps to support OCT personnel with presenting training evidences. Following effort should include discussions aiming to develop an integrated vision of how WBS 3 innovations may affect AAR activities.

4 Conclusion

The commitment of the AAAR project aims to support OCT authority with the application of the AAR process. No changes were suggested to the process itself. Instead, an OCT's R&D activities plan (section 3.4), proposing a set of improvements based on recent technological innovations, was defined. Several meetings were held to identify client needs that leaded to the definition of three (3) objectives.

The first objective (WBS 1) reveals that OCT training was an important issue for OCT authority. WBS 1.1 suggests supporting development of OCT competencies by using virtual in-class scenarios. Expected benefits want to lighten workloads dedicated to the preparation of live exercises. These scenarios are currently used by LFQA-TC for helping part-time OCTs to refresh their knowledge on the AAR process. In complementary, WBS 1.2 proposes to speed up the OCT learning process by proposing e-learning sessions prior the formal training.

The second objective (WBS 2) focuses on augmenting OCT's capabilities during the application of the AAR process. WBS 2.1 suggests exploiting smart devices to support capture of training evidence. For instance, networking capabilities of smart devices would allow storing training evidences in the cloud. OCT personnel could instantly share their training evidences between them and enhance their situational awareness comprehension during the training session. WBS 2.2 also recommends exploiting smart devices (such as iPad style tablet) to simplify the application of the AAR process. Paper based-forms should be replaced by intertwined online forms that could be fed by data gathered during training sessions. OCT follow-up reports and management tasks could be simplified by virtualizing the AAR process.

The third objective (WBS 3) explores different ways to present training evidences. WBS 3.1 raised concerns about using similar technologies dedicated to visualize training evidences. It was recommended assessing the possibility to reduce the number of visualization products, in order to optimize fees associate to licensing and maintenance. WBS 3.2 suggested assessing potential of virtual 3D environments to present training evidences. A 3D visualization could presents outstanding point of view of training evidences that complements standard 2D visualizations. A particular attention should be paid to the ease of use of these tools. At last, WBS 3.3 recommends exploring the potential of bio sensing to develop state reviews describing the physical and the psychological profile of the training audience.

This report highlight that OCT working environment could be enhanced by recent technological innovations. It opens simple opportunities to support OCT personnel in their duties. Despite the fact that the AAAR project was ended prematurely, this report succeeded to deliver a detailed R&D plan that can guide the OCT authority in its mission.

The OCT R&D plan was defined late in 2011. Given that the OCT authority reprioritized its efforts in R&D at the same time, it would be essential to clarify and validate if R&D objectives and activities still in the scope of the OCT authority. Their endorsement towards the OCT R&D plan should be obtained before to pursue any R&D activity presented in this report.

References

Adobe. (2013). Photoshop Inspiration, Photoshop Information | Photoshop.com. Retrieved November 5, 2013, from http://www.photoshop.com/

AIPTEK International Inc. (2012). MobileCinema i50S Projector for iPhone. Retrieved from http://www.aiptek.com.tw/c0_1.php?bid=18&pid=62

ALLC / CLRA. (1999). *The After Action Review Process: Learning More From Our Training, Dispatches – Lessons Learned for Soldiers* (Vol. 6 No. 3). Canadian Army Lessons Learned Centre.

ALLC / CLRA. (2012a, May 4). Canadian Army Lessons Learned Centre (ALLC) - Home. Retrieved from http://armyapp.forces.gc.ca/allc-clra/default-eng.asp

ALLC / CLRA. (2012b, October 3). Observer-Controller Doctrine - Home. Retrieved from http://armyapp.dnd.ca/ALLC-CLRA/aar/obs_cont_duties-eng.asp

Apple. (2013). Apple (Canada) - iPhone. Retrieved October 8, 2013, from http://www.apple.com/ca/iphone/

Apple Store (Canada). (2013). Parrot AR.Drone 2.0. Retrieved from http://store.apple.com/ca/product/H8859ZM/A/parrot-ardrone-20

Bernier, Francois, Boivin, E., & Bouchard, S. (2012). Teaching stress management skills to soldiers. DRDC Valcartier.

Bernier, François, Bouchard, S., & Boivin, E. (2013). *Teaching stress management skills to soldiers - A virtual reality approach* (No. TR 2013-057) (p. 128). DRDC Valcartier.

Betters, É. (2012). Review: iPhoneography series: iPhone Swivl and Lens Dial. *9to5Mac*. Retrieved from http://9to5mac.com/2012/11/18/review-iphoneography-series-iphone-swivl-and-lens-dial/

Bohemia Interactive Simulations. (2011). Virtual Battlespace 2 (VBS2). Retrieved from http://products.bisimulations.com/products/vbs2/overview

Boivin, E., Bernier, F., & Bouchard, S. (2012). A video game selection process for modding projects. Presented at the Meaningful Play 2012, East Lansing (Michigan).

Boivin, E., & Mokhtari, M. (2011). A Canadian After-Action Review Process Improvement Roadmap (pp. 14–1). Presented at the MSG-087 Symposium on "Enhance or Replace: Finding the Right Live vs. Synthetic Balance, Bern, Switzerland. Retrieved from http://ftp.rta.nato.int/public//PubFullText/RTO/MP/RTO-MP-MSG-087///MP-MSG-087-14.docx

BoxeWave. (2013). BoxeWave Keyboard Buddy iPhone 4S – Backlit Edition. Retrieved from http://www.boxwave.com/iphone-4s-cases-and-covers/keyboard-buddy-iphone-4s-case/bwpdd/pkz-zptc/

Buchanan, L. (2009). Learn From your Mistakes, Using a Military Technique | Inc.com. *Inc.*, *March 2009*. Retrieved from http://www.inc.com/magazine/20090301/leadership-armed-with-data.html

Charles, D., McNeill, M., McAlister, M., Black, M., Moore, A., Stringer, K., … Kerr, A. (2005). Player-Centred Game Design: Player Modelling and Adaptive Digital Games. In *Digital Games Research Association (DiGRA)* (Vol. 285). Vancouver, BC, Canada, June 16th-20th, 2005.

Chester, E. (2012). Review: Aiptek Launches Four Pico Projectors Especially For Mobile Phones. *Trusted Reviews*. Retrieved from http://www.trustedreviews.com/news/aiptek-launches-four-pico-projectors-especially-for-mobile-phones

CMTC. (2010). CMTC - Observer Controller Trainer Crse - Written PO Check.

CMTC / CCEM. (2012a). Canadian Manoeuvre Training Centre (CMTC) - Home. Retrieved from http://www.army.gc.ca/iaol/143000440000729/index-Eng.html

CMTC / CCEM. (2012b). Observer-Controller Trainer (OCT) - Home. Retrieved from http://www.army.gc.ca/iaol/143000440001161/143000440001164/index-Eng.html

CMTC / CCEM. (2012c). EX Maple Guardian 2011 - Home. Retrieved from http://www.army.gc.ca/iaol/143000440001201/143000440001202/index-Eng.html

Collison, C., & Parcell, G. (2001, August 9). Learning while doing: The after action review process - Inside Knowledge. *Inside Knowledge*, *Vol. 5 No. 1*.

Cook, S. (2010). iPhone Apps Bring Augmented Reality to War Games. Retrieved from http://www.tested.com/tech/ios/823-iphone-apps-bring-augmented-reality-to-war-games/

Corsix.org. (2008). *Corsix's Mod Studio*. Retrieved from http://www.corsix.org/cdms/general-1.html

Côté, B. (2012). *Familiarisation Revue postexercices* (No. CR 2013-xxx). Garnison Valcartier, Qc, Canada: Centre d'instruction - Secteur Québec de la force teresstre.

Crane, D. (2012). Defense Review - US Night Vision iPhone 4/4S AN/PVS-14 Night Vision/I2 Monocular Adapter. Retrieved from http://www.defensereview.com/us-night-vision-iphone-44s-anpvs-14-night-visioni2-monocular-adapter-shoot-clandestine-i2-combat-video-then-email-or-text-it/

Crevier, F. (2003). Un modèle MOT vaut mille mots... = A model MOT is a thousand words worth... *Revue internationale d'ingénierie des systèmes de production mécanique*, *2003*(7). Retrieved from http://cat.inist.fr/?aModele=afficheN&cpsidt=15429278

Crevier, F. (2011). *Développement d'un outil d'apprentissage pour l'observateur-contrôleur instructeur de l'Armée canadienne : Phase 1 - Analyse préliminaire* (No. CR 2013-xxx). Ellicom Inc.

Crevier, F., & Bradette, J.-P. (2012). *Développement d'un outil d'apprentissage pour l'observateur-contrôleur instructeur de l'Armée canadienne : Phase 2 - Conceptualisation et modélisation* (No. CR 2013-xxx). Ellicom Inc.

Cubic Field Services Canada Ltd. (2005). Canadian Weapon Effects System (CWES). Retrieved from http://www.cubicfsc.com/wainwright/

DAD / DDAT. (2006). B-GL-322-007/FP-002 – Force terrestre - Opérations particulières - Les opérations en zone urbaine. Forces canadiennes.

Darling, M. J., & Parry, C. S. (2001). After-Action Reviews: Linking Reflection and Planning in a Learning Practice. *Reflections: The SoL Journal*, *3*(2), 64–72.

Darling, M., & Parry, C. S. (2004). *From Post-mortem to Living Practice: An In-depth Study of the Evolution of the After Action Review*. Signet Consulting.

DRDC Valcartier, & CIMMI. (2011). Collaborative Research and Development Agreement On "Concepts Show-Case." DRDC Valcartier (SRE-11-067).

Gadd, W. (2011). Quick Review Notes on the Spot 2 and Spot Connect. *WillGadd*. Retrieved from http://willgadd.com/quick-review-notes-on-the-spot-2-and-spot-connect/

Gilion, B. (2010, November 27). How the corporate world can use the US Armys After Action Review to improve employees performances - by Brent Gilion - Helium. *Helium*. Retrieved from http://www.helium.com/items/2025085-how-to-improve-performance

Graham, R. (2001). Bikers Learn from the Army, Knowledge Management Magazine, February 2001. *Knowledge Management Magazine*, *February 2001*.

Horwitz, J. (2011). Review: BoxWave Keyboard Buddy Case for iPhone 4. *iLounge*. Retrieved from http://www.ilounge.com/index.php/reviews/entry/boxwave-keyboard-buddy-case-for-iphone-4/

Hudlicka, E. (2009). Affective game engines: motivation and requirements. In *Proceedings of the 4th International Conference on Foundations of Digital Games* (pp. 299–306).

iPhoneNess. (2010). 40 Best Augmented Reality iPhone Applications. Retrieved January 14, 2013, from http://www.iphoneness.com/iphone-apps/best-augmented-reality-iphone-applications/

Johnson, J. (2012). Review: Parrot AR Drone 2.0 - Your Own Private Predator. *gizmodo*. Retrieved from http://gizmodo.com/5931424/parrot-ar-drone-20-review-your-own-private-predator

LFDTS / SDIFT. (2009). A-P3-003-OCT/PH-B01 - Observer Controller Trainer. Canadian Forces.

Little, R. (2013). 16 Inspiring Examples of Interactive Maps in Web Design | Inspiration. Retrieved November 1, 2013, from http://webdesignledger.com/inspiration/16-inspiring-examples-of-interactive-maps-in-web-design

Microsoft Corporation. (2010). User Experience Interaction Guidelines for Windows 7 and Windows Vista. Microsoft Corporation. Retrieved from http://www.microsoft.com/en-us/download/confirmation.aspx?id=2695

MindMuze. (2009). The Big Muze. Retrieved June 18, 2013, from http://www.mindmuze.com/blog/2009/05/05/help-fight-the-h1n1-virus-swine-flu-with-our-free-elearning-module/

mophie. (2013). mophie juice pack PRO® outdoor edition - iPhone 4 & 4S Battery Case. Retrieved from http://www.mophie.com/mophie-juice-pack-PRO-iPhone-4-battery-case-p/2175_jppro-ip4-org.htm

Morrell, C. D. W. (1999). Improving Learning in the Canadian Army. *The Doctrine and Training Bulletin*, *Vol. 2, No. 4*(Winter 1999).

Nacke, L. E., Kalyn, M., Lough, C., & Mandryk, R. L. (2011). Biofeedback game design: using direct and indirect physiological control to enhance game interaction. In *Proceedings of the 2011 annual conference on Human factors in computing systems* (pp. 103–112).

Night Vision Experts. (2011). Night Vision Scope, PVS-14A Autogated Gen3 Night Vision Scope and Goggles. Retrieved from http://www.nightvisionexperts.com/pvs14.html

Paquette, G. (1993). *Une technique de modélisation des connaissances à des fins de formation*. Montréal, Qc, Canada: LICEF, Téléuniversité.

Parrot. (2012). AR.Drone 2.0. Retrieved from http://ardrone2.parrot.com/

Parry, C. S., & Darling, M. J. (2001). Emergent Learning In Action: The After Action Review. *The Systems Thinker – Building Shared Understanding*, *12*(8).

Paul, N. (2011). Deloitte Ethics. *Catalyst Pictures Ltd*. Retrieved June 18, 2013, from http://www.catalystpics.co.uk/work.php?id=22

Photojojo. (2011). Dial Lens for iPhone. Retrieved from http://photojojo.com/store/awesomeness/iphone-lens-dial/

PoiseCam LLC. (2013). PoiseCam | iPhone Camera Grip. Retrieved from http://poisecam.com/

Rogers, J. (2011). Review: Mophie Juice Pack Plus Outdoor Edition. *iSource*. Retrieved January 24, 2013, from http://isource.com/2011/11/23/review-mophie-juice-pack-plus-outdoor-edition-and-mophie-outdoors-app/

SimFront Corporation. (2007). *Aramis - An after action review application*. Retrieved from http://www.simfront.com/aramis.html

SPOT LLC. (2013). SPOT Connect. Retrieved from http://www.findmespot.ca/en/index.php?cid=116

Tableau Software. (2013). Tableau Product Suite. Retrieved November 1, 2013, from http://www.tableausoftware.com/products

U.S. Joint Forces Command (USJFCOM). (1997). *Joint Conflict and Tactical Simulation (JCATS)*. Retrieved from http://www.jfcom.mil

US Army Combined Arms Center. (2011, September). Leader's Guide to After-Action Reviews (AAR). US Army Combined Arms Center – Training, Ft Leavenworth, KS 66027. Retrieved from http://www.jackson.army.mil/sites/leaderdevelopment/docs/710

Van der Sterren, W. (2011, December 4). Canadian Army units (Arma*/VBS2), Sahrani Obregan area (VBS2). *PlannedAssault.com*. Retrieved June 18, 2013, from http://www.plannedassault.com/news_entries/199098169

Vande Moere, A. (2013). Information aesthetics - Data Visualization & Information Design - Home. Retrieved from http://infosthetics.com/

Wikipedia.org. (2013a). iPhone - Wikipedia, the free encyclopedia. Retrieved October 8, 2013, from http://en.wikipedia.org/wiki/IPhone

Wikipedia.org. (2013b). iPhone 4S - Wikipedia, the free encyclopedia. Retrieved October 8, 2013, from http://en.wikipedia.org/wiki/IPhone_4S

Wikipedia.org. (2013c). NATO Military Symbols for Land Based Systems - Wikipedia, the free encyclopedia. Retrieved October 21, 2013, from http://en.wikipedia.org/wiki/NATO_Military_Symbols_for_Land_Based_Systems

Wikipedia.org. (2013d). Interoperability - Wikipedia, the free encyclopedia. Retrieved October 22, 2013, from http://en.wikipedia.org/wiki/Interoperability

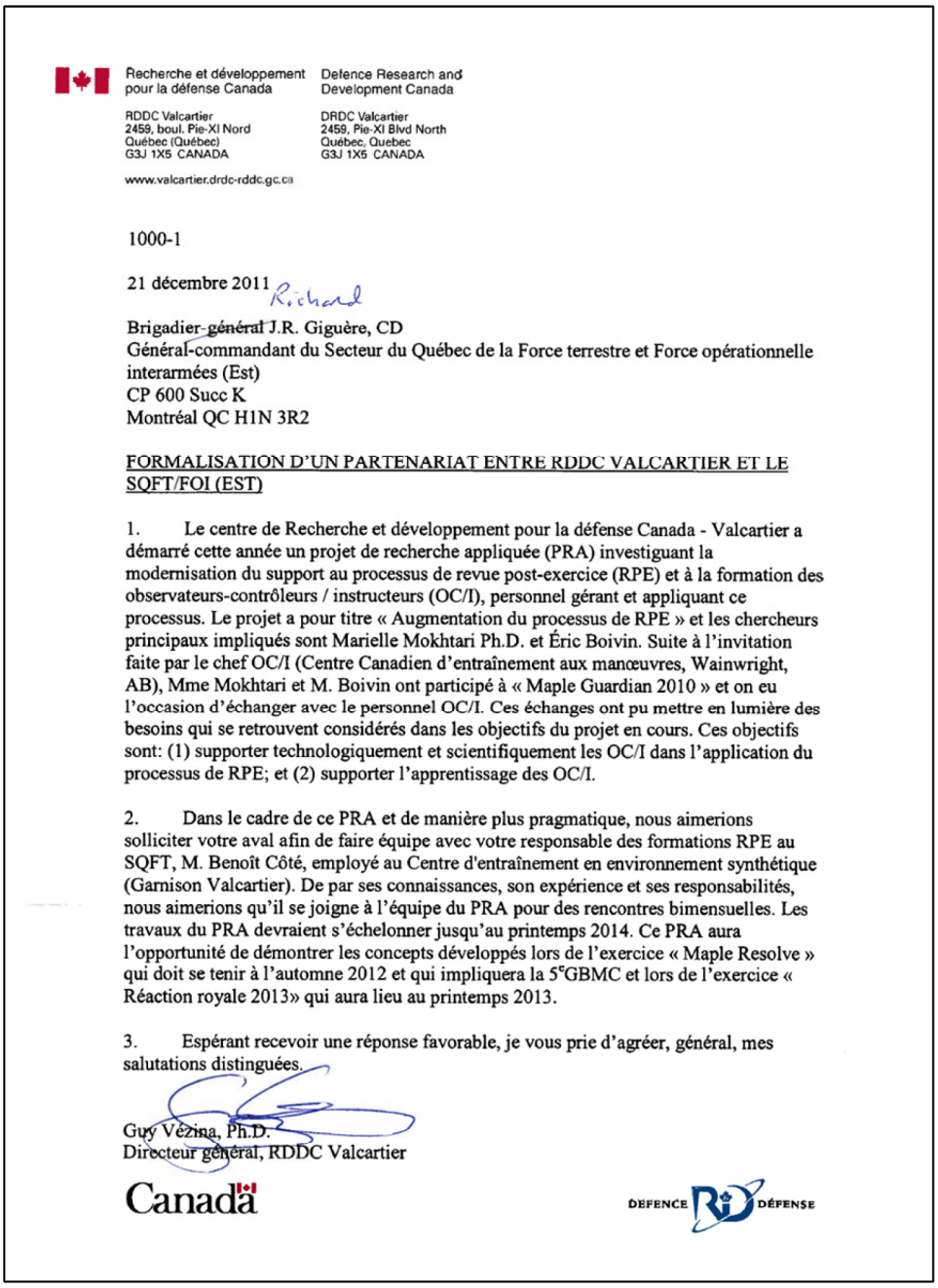
Wikipedia.org. (2013e). Company of Heroes - PC Video Game. Retrieved November 1, 2013, from http://en.wikipedia.org/wiki/Company_of_Heroes

Wikipedia.org. (2013f). World in Conflict - PC Video Game. Retrieved November 1, 2013, from http://en.wikipedia.org/wiki/World_in_Conflict

World Armies. (2013). An OCT at MAPLE RESOLVE 2013. Retrieved October 22, 2013, from http://www.flickr.com/photos/46146685@N04/8961850557/in/photolist-eDVPWM-dLSPYN-bkgN94-8rRNXa-bnQwqH-axwzTy-dnKL1B-dnKLye-efUY2r-efUXXD-fWcTB5-dYdjGy-fWcPLs-dYdjNC-dYdjq7-aCdqrr-aCdqcp-aCdqoi-aCguv9-aCgur5-dY7P8i-dYdrwL-dY7J7K-dY7Bua-fWcShS-fWd5G8-dYdJ11-dYdjBw-dY7P6z-dYdjw7-dY81Vg-dYdvDS-dYdJ51-dYdvCC-dYdvBE-dY82Rt-dYdvyY-dY7JB8-dYdJqd-dY7JN6-euh7rK-aSs2Er-8SNxMf-dbHPG2-bZdvJw-cPbTG1-d6LJhU-bSqFfF-dVaW6b-7VC2LD

Annex A Partnerships

A.1 Partnership proposal – DRDC Valcartier & LFQA



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1000-1

21 décembre 2011 Richard

Brigadier-général J.R. Giguère, CD
Général-commandant du Secteur du Québec de la Force terrestre et Force opérationnelle interarmées (Est)
CP 600 Succ K
Montréal QC H1N 3R2

FORMALISATION D'UN PARTENARIAT ENTRE RDDC VALCARTIER ET LE SQFT/FOI (EST)

1. Le centre de Recherche et développement pour la défense Canada - Valcartier a démarré cette année un projet de recherche appliquée (PRA) investiguant la modernisation du support au processus de revue post-exercice (RPE) et à la formation des observateurs-contrôleurs / instructeurs (OC/I), personnel gérant et appliquant ce processus. Le projet a pour titre « Augmentation du processus de RPE » et les chercheurs principaux impliqués sont Marielle Mokhtari Ph.D. et Éric Boivin. Suite à l'invitation faite par le chef OC/I (Centre Canadien d'entraînement aux manœuvres, Wainwright, AB), Mme Mokhtari et M. Boivin ont participé à « Maple Guardian 2010 » et on eu l'occasion d'échanger avec le personnel OC/I. Ces échanges ont pu mettre en lumière des besoins qui se retrouvent considérés dans les objectifs du projet en cours. Ces objectifs sont: (1) supporter technologiquement et scientifiquement les OC/I dans l'application du processus de RPE; et (2) supporter l'apprentissage des OC/I.

2. Dans le cadre de ce PRA et de manière plus pragmatique, nous aimerions solliciter votre aval afin de faire équipe avec votre responsable des formations RPE au SQFT, M. Benoît Côté, employé au Centre d'entraînement en environnement synthétique (Garnison Valcartier). De par ses connaissances, son expérience et ses responsabilités, nous aimerions qu'il se joigne à l'équipe du PRA pour des rencontres bimensuelles. Les travaux du PRA devraient s'échelonner jusqu'au printemps 2014. Ce PRA aura l'opportunité de démontrer les concepts développés lors de l'exercice « Maple Resolve » qui doit se tenir à l'automne 2012 et qui impliquera la 5eGBMC et lors de l'exercice « Réaction royale 2013» qui aura lieu au printemps 2013.

3. Espérant recevoir une réponse favorable, je vous prie d'agréer, général, mes salutations distinguées.

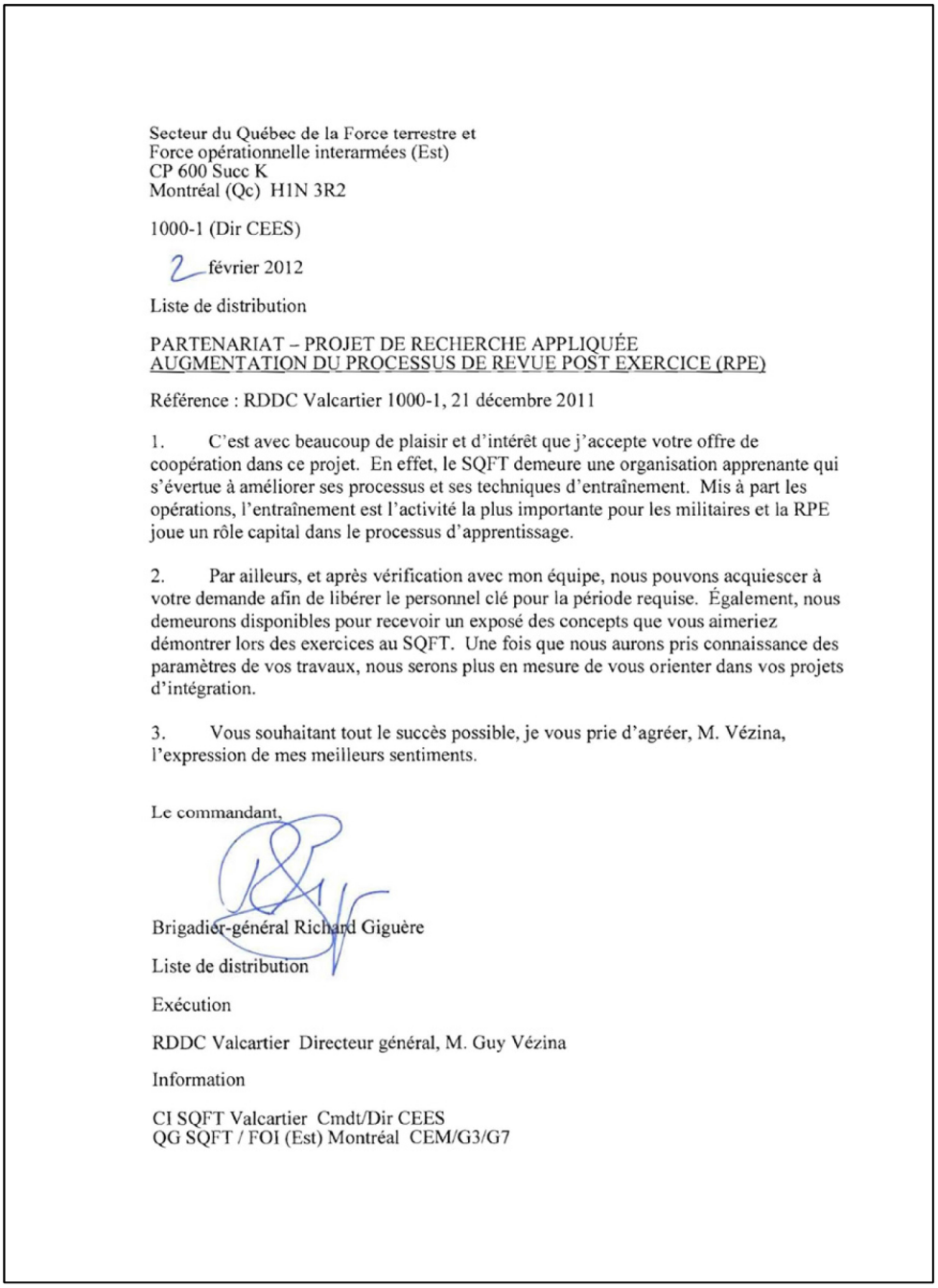
Guy Vézina, Ph.D.
Directeur général, RDDC Valcartier

Canada

DEFENCE R&D DÉFENSE

Figure 60: Partnership proposal – DRDC Valcartier & LFQA HQ

A.2 Partnership agreement – DRDC Valcartier & LFQA



Secteur du Québec de la Force terrestre et
Force opérationnelle interarmées (Est)
CP 600 Succ K
Montréal (Qc) H1N 3R2

1000-1 (Dir CEES)

2 février 2012

Liste de distribution

PARTENARIAT – PROJET DE RECHERCHE APPLIQUÉE
AUGMENTATION DU PROCESSUS DE REVUE POST EXERCICE (RPE)

Référence : RDDC Valcartier 1000-1, 21 décembre 2011

1. C'est avec beaucoup de plaisir et d'intérêt que j'accepte votre offre de coopération dans ce projet. En effet, le SQFT demeure une organisation apprenante qui s'évertue à améliorer ses processus et ses techniques d'entraînement. Mis à part les opérations, l'entraînement est l'activité la plus importante pour les militaires et la RPE joue un rôle capital dans le processus d'apprentissage.

2. Par ailleurs, et après vérification avec mon équipe, nous pouvons acquiescer à votre demande afin de libérer le personnel clé pour la période requise. Également, nous demeurons disponibles pour recevoir un exposé des concepts que vous aimeriez démontrer lors des exercices au SQFT. Une fois que nous aurons pris connaissance des paramètres de vos travaux, nous serons plus en mesure de vous orienter dans vos projets d'intégration.

3. Vous souhaitant tout le succès possible, je vous prie d'agréer, M. Vézina, l'expression de mes meilleurs sentiments.

Le commandant,

Brigadier-général Richard Giguère

Liste de distribution

Exécution

RDDC Valcartier Directeur général, M. Guy Vézina

Information

CI SQFT Valcartier Cmdt/Dir CEES
QG SQFT / FOI (Est) Montréal CEM/G3/G7

Figure 61: Partnership agreement – DRDC Valcartier & LFQA HQ

Annex B DRDC Valcartier Laboratories

B.1 Gaming and Emerging Technology Laboratory (GET Lab)

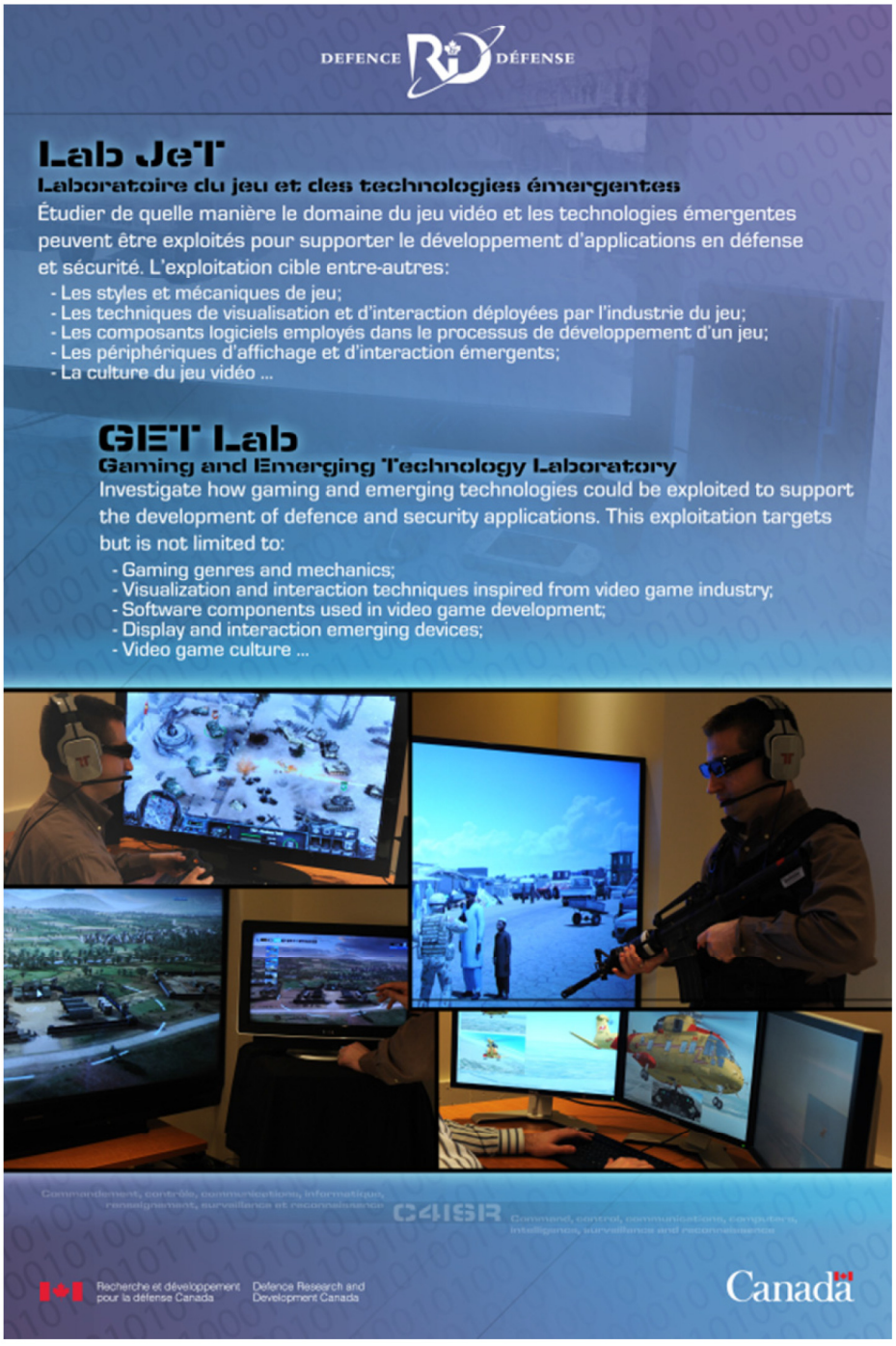


Figure 62: Poster – Gaming and Emerging Technology Laboratory (GET Lab)

B.2 Virtual Immersive Facility (VIF)

Figure 63: Poster – Virtual Immersive Facility (VIF)

Annex C Unsubmitted R&D contract aiming to support the AAAR project

This draft of R&D contract has never been submited for a call of proposal. It was designed to support WBS activities presented into this report. It has been added to this report in order to support any futher R&D activity associated to this project.

R&D contract (Draft)

Statement of work

1. GENERAL

1.1 Title

Digitalization and enhancement of the application of the After-Action Review (AAR) process of the Canadian Army.

1.2 Objective

The objective of this contract is to support military personnel in the application of the AAR process defined by the Canadian Army. The contract involves the integration of technological tools that can digitize and enhance various steps and sub-steps of the AAR process.

The specific objectives of this contract are:

A. Analyze the current means used in the application of the AAR process;

B. Investigate, develop and / or enhance the technological tools that support:

a. Information processing, analysis and management associated with different steps of the AAR;

b. Learning and confirmation of knowledge in the application of the AAR process;

C. Integrate technological tools developed or improved within the activities of military personnel;

D. Support the evaluation of technological tools developed or improved during training exercises.

Military personnel targeted by the work may include, but is not limited to:

4. Observers-Controllers / Trainers (OC/Ts) in charge of supervising the application of the AAR process;

5. OC/T trainers in charge of teaching the application of the AAR process;

6. Unit commanders in charge of conducting the AAR;

7. The military training audience.

The work should be part of an implementation strategy to ensure at least maintaining the levels of current performance and efficiency for all steps of the AAR process. The definition and management of this strategy will be supervised by the Canadian Army and Defence Research and Development Canada.

2. SCOPE OF WORK

General

This contract supports the design, development and validation of software tools. This contract will be carried out by authorities to task (ATs). When the contract is in place and for its duration, the Scientific Authority (SA) will require work by triggering ATs. The tasks and subtasks are described below. Each of the ATs can refer to more than one task and / or subtask. Each task or subtask may be activated more than once.

Task A – State of the art

A.1. Conduct a review of the literature on the military and civilian needs specified. The need may relate to aspects of learning, collection, visualization, analysis, representation of data / information, or any other needs relevant to the development of the tool suite;

A.2. Identify trends, techniques, tools or the most promising approaches in relation to specific needs;

A.3. Write a report detailing the results of the literature review on the need specified by providing references and an executive summary.

Task B – Options Analysis (OA) - Application of the AAR Process

B.1. Assess the resources currently used in the application of a part or a subset of the AAR process identified by the SA;

B.2. Produce an OA detailing proposals will enhance the technological application of the part or subpart of the AAR process identified by the SA;

B.3. Estimate the resources and costs required to implement the proposals adopted by the TA. Document the OA.

Task C – Learning Process

C.1. Identify the skills and abilities to develop and / or increase in the context of the implementation of the AAR process by the OC/Ts;

C.2. Define the process of developing skills and abilities;

C.3. Defining the skills and abilities development techniques (related tools) to facilitate the learning of the application of the AAR process;

C.4. Estimate the resources and costs required for implementing techniques for the development of skills and abilities identified by the SA;

C.5. Document the process developed.

Task D – Software Tools

D.1. *System architecture*: if existing architecture then study the current architecture, identify the changes required, develop the new architecture and document else develop / build architecture and document;

D.2. *Commercial tools*: if required, purchase and install commercial software (off the shelf software). This excludes the purchase of the software used for development;

D.3. *Development environment*: if existing environment then consider the current environment, identify changes required and apply these changes and document else develop / build environment and document;

D.4. *Development of a module in the system*: if existing module then study the existing module, design the new module, build and test it then design the module, build and test it;

D.5. Correct and / or modify the system according to the priority of problems and requests of changes recorded;

D.6. Develop a set of acceptance tests based on the specified scenario designed for end users and / or participants in the experiments;

D.7. Delivery of a version of the system that includes:

1. Migrate the modules to the appropriate environment for tests;

2. Coordinate acceptance tests (performed by individuals who are not part of the development team);

3. Develop and test a delivery installation kit.

Task E – Experimentation

E.1. Suggest improvements to the experimental protocol originally provided by the SA during a meeting with the DRDC research team;

E.2. Develop the ethics protocol, respecting DRDC guidelines for human participation in research projects;

E.3. Recruit civilian or military participants;

E.4. Create the testing environment, including hardware, software, questionnaires, and calendar. This may include the purchase of hardware and software;

E.5. Perform experiment and collect experimental data;

E.6. Analyze data and summarize the results.

Annex D AAR Report Example

Example of a AAR report presented into the OCT Academy Class.

AFTER ACTION REVIEW (AAR) / RÉVISION POST EXERCICE (RPE)

EX :	Date :
Stand # / No de Plateau :	Time / Heure :
PTA/ Audience cible :	OCT/OCF :

KEY EVENT / ISSUES

ÉVÉNEMENT CLÉ / POINTS DE DISCUSSION

KEY EVENT / ÉVÉNEMENT CLÉ	ISSUES / POINTS DE DISCUSSION	SOLUTION	OPI
• Scene Mgt o No on scene comd ID immed o No link up with C/S 42 o Site Contamination o TPT/CIMIC not used for cordon	• Chaos overwhelmed first responders, no ctrl of scene • On scene comd did not conduct a link up with 42 to give sit rep, estb ch of comd and pri of effort • 1st SIED site was contaminated • TPT/CIMIC were not used to interact with LNs	• One pers must take charge of sit until sp arr • Link up must occur with on scene comd and sp elms to better manage the scene • Pers must ensure site is not contaminated for safety and int coll • Use enablers & their speciality	Comds at all lvls
• Coy IA Drills o Ineffective cordon on WEST side of village	• WNG-SEC-RECCE-PLAN. Area must be secure fr INS influence prior to completing the task	• Fol Coy TTP to ensure site is secured fr further INS influence i.e. robust cordon	
• CASEVAC	• No system was fully in place to keep tracj of numerous CAS, delaying triage	• Put in effect CAS tag system to clearly ID CAS, their pri & treatments given	Medics

OCT's OVERALL COMMENTS /

COMMENTAIRES GÉNÉRAUX DE L'OCF

An excellent event. The Pl WO quickly grasped the sit and managed the chaos to ensure CAS were treated & evac in a timely fashion. Interaction with LN's was also strong despite their emotional state as a result of the event.

Duration of AAR /Durée du RPE: 60min

Rank/Name of OCT:
Position of OCT:
Unit of OCT:

List of symbols/abbreviations/acronyms/initialisms

AC	*Armée canadienne*
ALLC	Army Lessons Learned Center
AAAR	Augmented After-Action Review
AAR	After-Action Review
ASC	Area Simulation Center
AR	Augmented Reality
BGen	Brigadier-General
BTS	Battle Task Standard
C2	Command & Control
CA	Canadian Army
CAF	Canadian Armed Forces
Capt	Captain
CCEM	*Centre canadien d'entraînement aux manœuvres*
CFB	Canadian Forces Base
CMTC	Canadian Manoeuvre Training Centre
CFMSC	Canadian Forces Medical Simulation Centre
CWES	Canadian Weapon Effects Simulation system
DBRT	*Direction des besoins en ressources de l'armée de terre*
DCSEM	Director of Combat Support Equipment Management
DLR	Director of Land Requirements
DND	Department of National Defence
DRDC	Defence Research & Development Canada
EX	Exercise
GSR	Galvanic skin response
HR	Heart rate
IT	Information Technology
JCATS	Joint Conflict and Tactical Simulation
JSAF	Joint Semi-Automated Forces
LCol	Lieutenant-Colonel
LFQA	Land Forces Quebec Area

LVC	Live Virtual Constructive
Maj	Major
OCI	Observateur contrôleur instructeur
OCT	Observer-Controller Trainer
P. Eng	Professional Engineer
R&D	*Recherche et développement*
R&D	Research & Development
RDDC	*Recherche et développement pour la défense Canada*
RPE	*Revue post exercise*
ROE	Rules of Engagements
SDK	Software Development Kit
SMT	Stress Management Training
TC	Training Center
TI	*Technologie de l'information*
TS	Training session
VBS2	Virtual Battle Space 2
VG	Video game
WO	Warrant Officer

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This report presents the research and development (R&D) work carried out under the *Augmented After-Action Review* project (in french *Revue postexerice de demain*) (2010-2013) authorized by the client group *2T - Integrated Analysis of Land Force*. The work support the *Observer-Controller Trainer* (OCT) staff of the Canadian Army in the learning and use of the *After-Action Review* (AAR) process. The report presents a R&D plan divided into four (3) topics aiming to: (1) Reduce time and cost of training OCT staff; (2) Enhance operational capabilities of OCTs when dealing with the AAR process; and (3) Extend the scope of feedback to staff when conducting AAR sessions.

Ce rapport présente les travaux de *recherche et développement* (R&D) réalisés dans le cadre du projet *Revue postexerice de demain* (en anglais *Augmented After-Action Review)* (*2010-2013*) du groupe client *2T – Analyse intégrée de la force terrestre*. Les travaux réalisés appuient l'*observateur-contrôleur instructeur* (OCI) de l'Armée canadienne dans l'apprentissage et l'application du processus de *revue postexercice* (RPE). Le rapport présente un plan de R&D divisé en 4 thèmes explorant les bénéfices potentiels destinés à : (1) Réduire les temps et les frais des activités de formation du personnel OCI; (2) Bonifier les capacités opérationnelles des OCIs dans l'application du processus RPE; et (3) Élargir la portée des rétroactions envers le personnel à l'entraînement lors de conduite de RPE.

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After Action Review; AAR; Observer-Controller Trainer; OCT; Training; Virtual Battlesapce 2; VBS2; Revue postexercice; RPE; Observateur-contrôleur instructeur; OCI;

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