A Canadian After-Action Review Process Improvement Roadmap

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ABSTRACT

Improving soldier, leader and unit performance is the main goal of the After-Action Review (AAR) which is a professional discussion on a training event that focuses on identifying what happened, why it happened and ways to improve training. This discussion allows participants to quickly and consistently learn (the most) from their experiences. AAR is supported by a sequential four-phase process: Planning, Preparation, Conduct and Follow-Up. Observers-Controllers-Trainers (OCTs) from Canadian Army are professionally, operationally and institutionally credible soldiers who accompany an organization during training and implement 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.

The OCT's role is particularly critical during the Conduct phase of the AAR process. OCT must guide the discussion within the training audience on relevant events extracted from the Preparation phase. Identifying and capturing these events for the Conduct phase represent a great challenge. Fortunately, OCT can benefit of tracking systems to augment their personal analysis of the training sessions. The Canadian Weapon Effects Simulation system, that captures status and actions of units during a live training, is one of these. The Virtual Battle Space 2 training simulator integrates similar functionalities to address the virtual training purpose. Finally, Joint Conflict and Tactical Simulation-based exercises benefit of Aramis, a replay software, to analyse and capture key training events for constructive training. Regardless of whether the training is live, virtual, constructive or even blended, OCT's observations should lead to the same objective: conducting an efficient AAR session supported by a strong analysis.

The continuous improvement of synthetic simulators, often inspired by the video game industry, slightly encourages the shift of live training to synthetic training. OCT should be aware of these upcoming capabilities to maximize the benefit of training. Nevertheless, emergent and mobile technology trends also open new opportunities for live training. OCT should consider the potential of these new devices to support their duties especially on the field for collecting data, controlling activities and performing data analysis. These technological trends do not only influence the way to do training, but also the way to perform the AAR. The Augmented After-Action Review project, led by Defence R&D Canada, aims to support the AAR process by taking into account of these technological improvements in order to develop OCT's competencies and also OCT's learning.

This paper presents technological innovations which could be introduced into the AAR process in order to support OCT in their duties and also their own learning.

Note: There no restrictions regarding presentation neither during the conference nor of the publication of the paper in the Meeting Proceedings.

1.0 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 phones, 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 [9] for virtual training, and the deployment of the *Canadian Weapon Effects Simulation system* (CWES) [8] 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* project, led by *Defence R&D Canada*, 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.

2.0 AFTER-ACTION REVIEW 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"[20].

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 [1]. 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" [21].

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 [23]" [22].

Considering the U.S. Army success, the other U.S. military services and the Civilian sector have rapidly adopted the AAR model [22] [24-26].

2.1 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 Centre (ALLC) [3]. But since several months, 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 [2][5], 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 as blended training (from the first Canadian documents [3][19] to the most official ones [2][5]). 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 staff), *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 [8] captures the status and actions of units during a live training. VBS2 [9] training simulator integrates similar functionalities to address the virtual training purpose. Finally, Joint Conflict and Tactical Simulation (JCATS [10])-based exercises benefit of Aramis [11], 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.

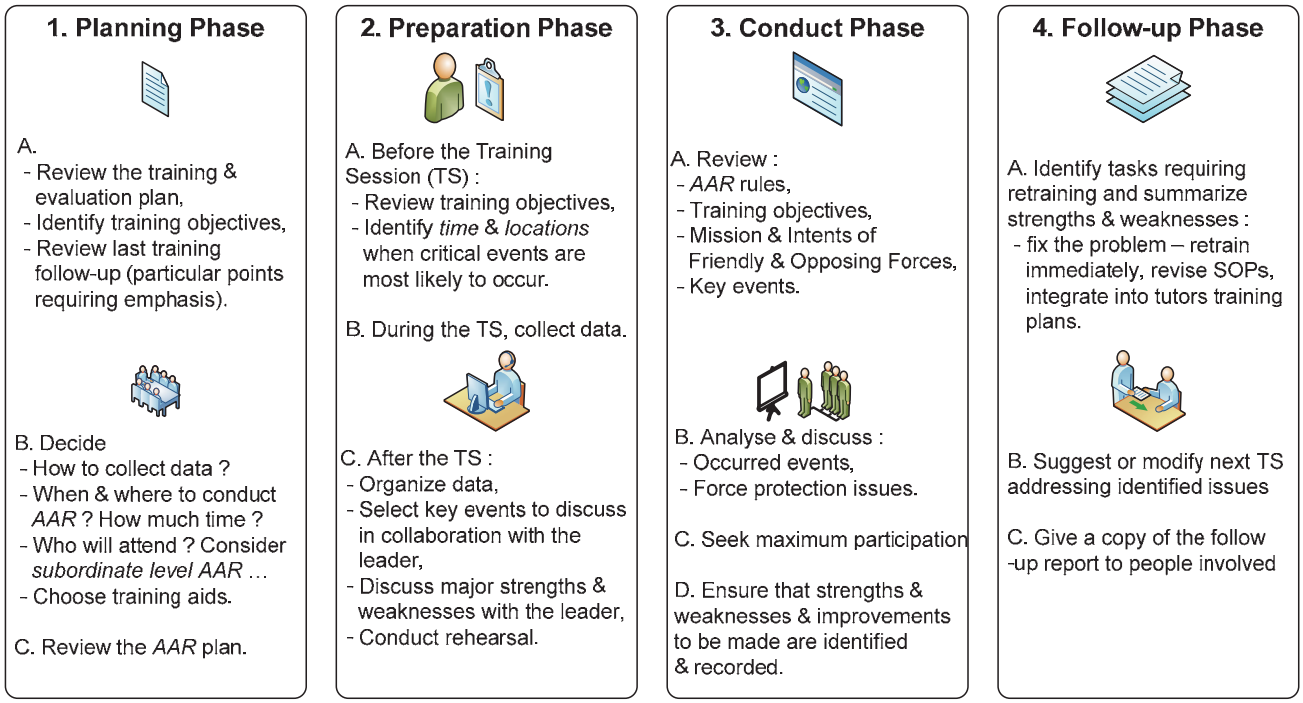

Figure 1: (Typical) AAR Process and OCT's duties/activities

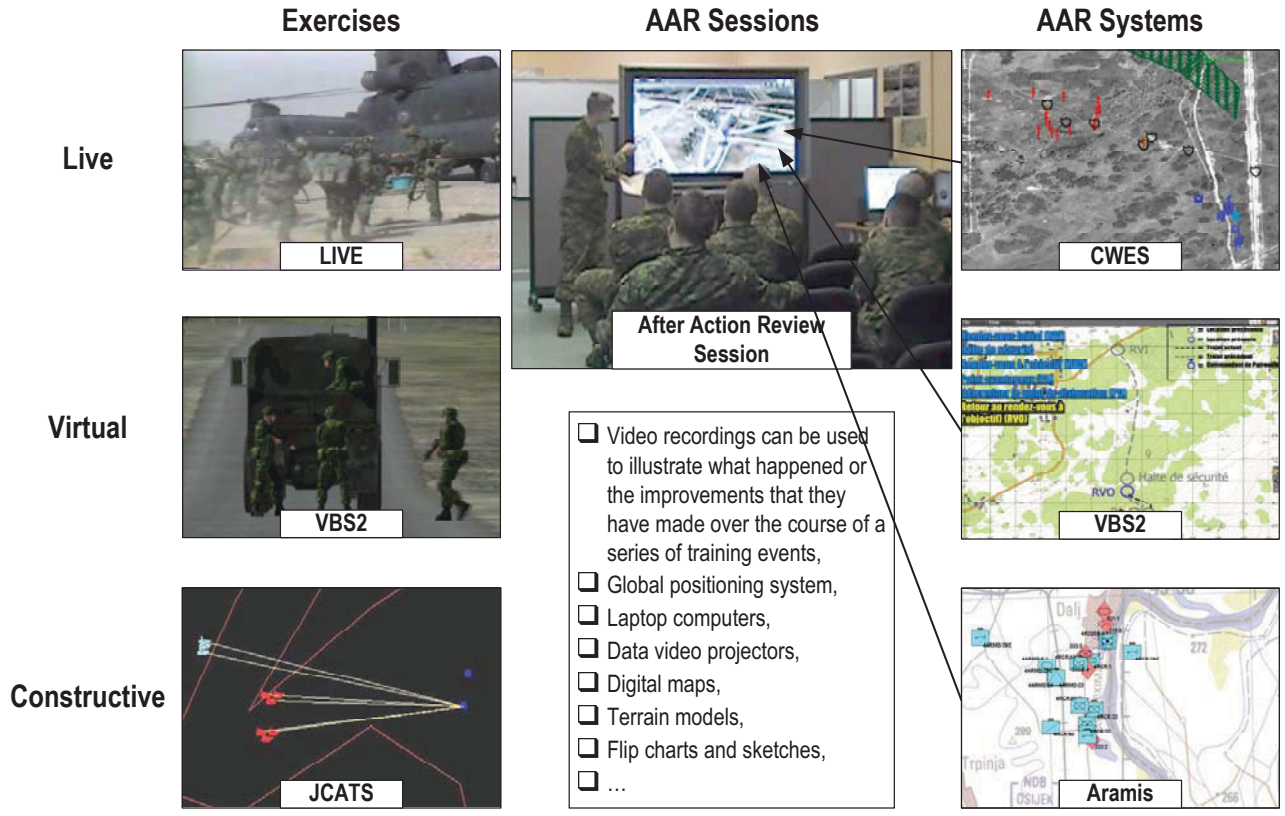

Figure 2: Example of available systems for LVC training exercises and AAR sessions

2.2 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 Observers-Controllers-Trainers (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 staff 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 [4][6].

2.3 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. 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 [21].

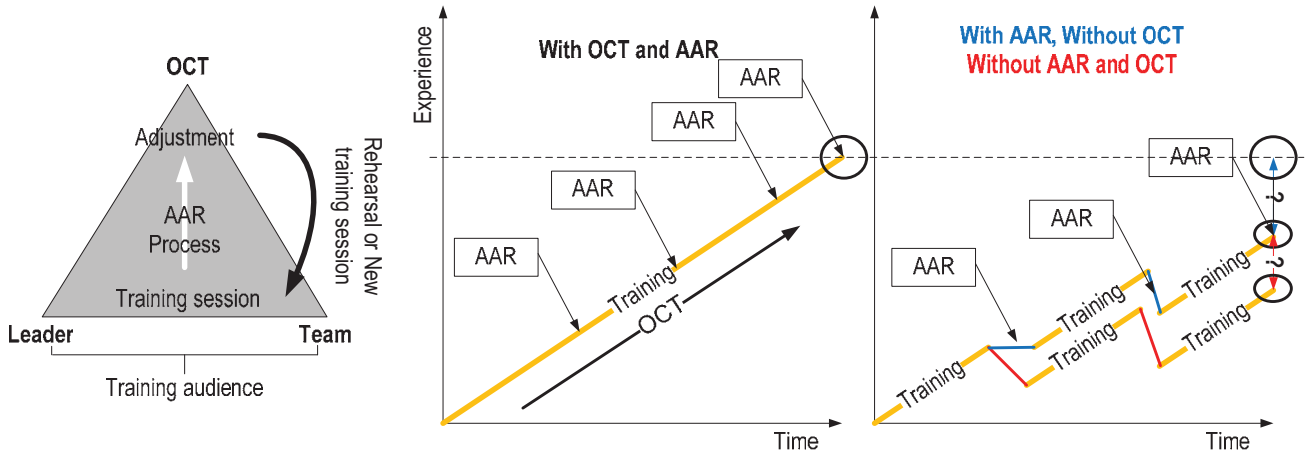

Figure 3: AAR Process Benefit – (Left) The necessary intricateness, (Middle) The right balance, (Right) The performance loss.

3.0 IMPROVEMENT ROADMAP

This section presents improvement trends aiming to assist the OCT personnel into their duties and to help them in their own learning. This section does not suggest any change to the AAR process itself. The proposed improvements are supported by technological innovation domains not limited to virtualization, mobility, augmented reality, visualization, e-learning and serious gaming.

3.1 Digitalize and Virtualize the AAR Process

The Canadian ALLC has initiated the digitalization of the AAR process by making available, through its website [2], 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.

To mitigate the loss of valuable knowledge, three improvement steps are suggested. The first step is to pursue 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.

The second step 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.

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.

3.2 Improve Situational Awareness Capabilities

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.

The challenge is simpler for virtual and constructive training than for live training. Current simulator systems, such as VBS2 and 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.

For live training, OCT personnel have to develop means to mitigate their limited situational awareness capabilities induced by the vastness of training field. OCT personnel have to synchronize their displacements among themselves in order to follow the training progress. Some OCT personnel have integrated the use of a smart phone within their activities. During the TS, they could benefit of many advantages 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. The next step should regulate and institutionalize the use of smart devices to support OCT personnel.

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 [12][13][14]. 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.

3.3 Prepare Clear Evidences for Discussion (AAR Session)

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.

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* [15] presents inspiring examples having the potential to enable the viewer to understand the information. This improvement could reduce time to prepare clear evidences.

In order to accelerate the TS analysis, visualization templates could be fed in real time by tracking systems. Combined with mobile devices, it could offer to OCT personnel the possibility to consult various predefined visualization representations during the *Preparation* phase (directly during the TS). The intent is to inform the OCT personnel early in the training phase in order to let them the possibility to focus on particular aspects of the training or even to adapt the ongoing scenario.

Semi-automated analysis represents another axis that could support OCT personnel in their task of preparing clear evidences. This approach aims at pointing out automatically, through training system logs, specific trainee's behaviours or basic sequences of actions that might not meet military standards or procedures. Of course, results generated by this kind of system must be validated by OCTs before to be identified as a discussion topic.

3.4 Conduct Effective AAR Sessions

As mentioned previously, an AAR session is not a typical post-mortem. Training audience should discover by itself what happened and how they should react if the same situation happens again. OCT personnel must be proactive by disclosing prepared evidences or references that support the discussion. However, be proactive within a linear slide presentation requires preparation. Frequently, the presentation outline drives the AAR session which has the effect of curbing the discussions among the training audience.

Instead of supporting an AAR session with a linear slide presentation, OCTs should have the capability to disclosure the appropriate information (charts, graphs, videos ...) on-demand. This shift would shape and personalize the course of the presentation in function of the training audience style. However, OCTs should have access to advanced presentation tools where they would be able to select and broadcast information on-demand using a tablet device and a large display projection system.

3.5 Develop and Maintain OCT's Competencies

Large training exercises (such as Maple Guardian 2011 [7]) require part-time OCTs. CMTC provides the essential foundations of AAR process theory through its OCT Academy class. Time required for this training could be reduced by introducing e-learning sessions focused on specific competencies (see section 2.2) that an OCT must have, improve or develop. Besides the fact that e-learning sessions could be used to suggest complementary training for future OCTs, these sessions have the potential to identify good candidates for key position. For instance, strong speaking and leadership competencies are required to conduct an AAR session in front of a military audience.

3.6 Integrate Physiological & Psychological States Review

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 of the video game industry (i.e. *adaptive gaming*[1], *biofeedback gaming*[2] and *affective gaming*[3]*)*. Thereby, future AAR session could benefit of these new data sets in order to provide physiological and psychological states review of the training audience.

4.0 CONCLUSION

This paper highlights that OCT working environment is influenced by technological breakthroughs. Technologies take more space within training activities and open opportunities to support OCT personnel in their duties. Based on an initial issue identification phase, a first set of technological improvements is proposed to support the application of the AAR process.

The following step of the Augmented AAR project includes a refinement phase of suggested improvements and an official endorsement of the roadmap by Canadian OCT authorities. These efforts should lead to define the optimal implementation timeframe of the roadmap (i.e. today, tomorrow or future).

In addition, this project will initiate two exploratory works. The first one foresees the development of an e-learning application prototype aiming to support part-time OCT competencies. The second one wants to assess

[1] An adaptive game provides a more appropriate level of challenge, smooth the learning curve, and enhance the gameplay experience for players regardless of experience [16].

[2] A biofeedback game exploits player's biometrics measurements to modify the gameplay experience [17]

[3] An affective game supports the recognition and expression of user and game character emotions [18].

the benefit of using smart devices on the field during a live training. The upcoming results should help to assess the relevance of these improvements in function of CA organisational constraints.

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