FINAL CONTRACT REPORT
(CRTI 09-0509TD PROJECT)

FIRST RESPONDER IMMERSIVE TRAINING SIMULATION ENVIRONMENT (FRITSE)
Scenario Development and Support

BY

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Date: 30 JULY 2014

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PWGSC Contract Number: W7702-125292/001/SV

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Defence Research and Development Canada
Contract Report
DRDC-RDDC-2014-C256
November 2014

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Table of Contents Page

1. Project Number and Title 3
2. Author of Report and DRDC-CSS Contacts 3
3. Organization Chart of Key Contributors/Partners and Roles 3
4. Duration of R&D Project and Cost 4
5. Executive Summary 4
6. Background (from Project Charter) 5
7. Objective (from Project Charter) 7
8. LuomaTech Inc Work Tasks and Milestones (from Project Charter and PWGSC Contract W7702-125292/001/SV) 7
9. Results 9
10. Milestones Completed (As Per Contract W7702-125292/001/SV) 13
11. Deliverables (As Per Contract W7702-125292/001/SV) 13
12. Discussion and Recommendations For Future Work 13

Appendix A: Highlight Sheet for FRITSE Project 16

1. Project Number and Title

CRTI-09-0509TD First Responders Immersive Training Simulation Environment (FRITSE)

2. Author of Report and DRDC-CSS Contacts

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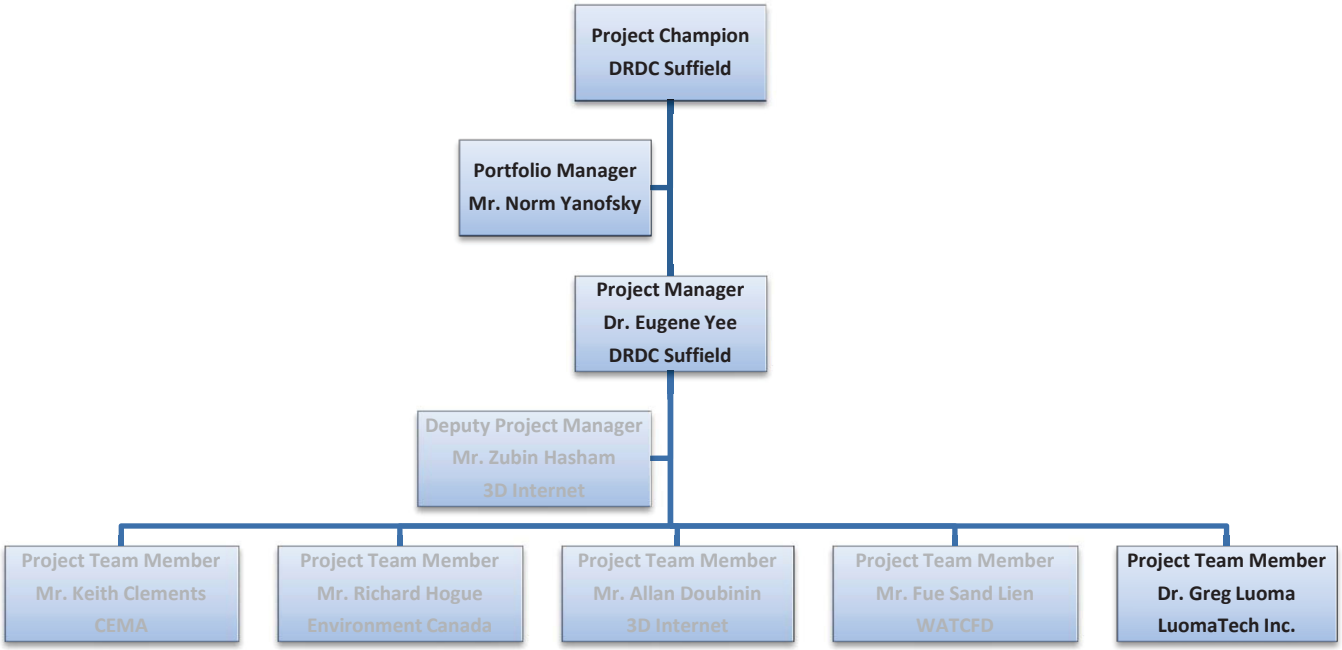
3. Organization Chart of Key Contributors/Partners and Roles



This is the final report for the LuomaTech Inc. tasks within the overall FRITSE project. It IS NOT the final report for the overall project.

4. Duration of R&D Project and Cost

LuomaTech Inc. completed the following three tasks for the CRTI-09-509TD FRITSE project between January 2012 and June 2014 as listed in PWGSC Contract W7702-125292/001/SV. The completed tasks were:

- Task 1: Development of CBRN Scenarios (Vignettes)
- Task 2: Advise on the Design/Development of CBRNE Equipment for Synthetic Environment
- Task 3: Contribute to Preparation of Presentations/Papers for Conferences/Symposia

The total cost of the LuomaTech Inc. portion of the project was $358,000 of which $200,000 was supplied by the CRTI program and $158,000 was supplied by LuomaTech Inc. as in-kind contributions. The following is the break-down of the budget by tasks:

Total by Fiscal Year	**Dates**	**CRTI Funds**	**In-kind Effort**
Task 1: Development of CBRN Scenarios (Vignettes)	Jan 2012 – Jun 2012	$49,000	$40,000
Task 2: Advise on the Design/Development of CBRNE Equipment for Synthetic Environment	Jul 2012 – Jun 2013	$117,000	$88,000
Task 3: Contribute to Preparation of Presentations/Papers for Conferences/Symposia	Jul 2013 – Jun 2014	$34,000	$30,000
Grand Total		**$200,000**	**$158,000**

5. Executive Summary

CBRNE training for first responders in Canada currently consist of on-line training complemented with occasional field exercises. Completing all levels of training is expensive, includes significant time away from normal duties, and is limited to a small proportion of the end-user community. The current curriculum does not utilize training in a simulated urban environment using realistic hazard scenarios. Thus, there is a significant capability gap/need in providing realistic training for all first responders.

The objective of the FRITSE project was to develop a highly realistic, game-based simulation environment for first responders to conduct team training and collaborations in order to more effectively address deliberate or accidental releases of CBRNE materials in urban environments. This was to be achieved by developing a realistic multi-event urban scenario for a chemical or biological attack, and integrating an accurate urban dispersion model for a high-fidelity GIS representation of an urban setting (Calgary) with a proven game-based simulation engine (with accurate renderings of buildings, equipment and avatars) to produce a simulation environment that is realistic and engaging.

The tasks addressed by LuomaTech Inc. included leading the development of the scenario for a multi-event railway incident in an urban setting that included an initial train derailment followed shortly after by a release of chemical agent and shortly after that a massive explosion in a highly populated and politically sensitive and busy commercial area of downtown Calgary. LuomaTech Inc. was also tasked to participate in the development of accurate renderings of equipment, development of avatars, and integration of the correct behaviours based on first responder operating procedures. Finally,

LuomaTech Inc. was tasked with contributing to the preparation of papers and presentations on the project for scientific and other symposiums. In addition to these three contracted tasks, LuomaTech Inc. provided project management leadership early in the project to arrange and document team meetings, and also prepared a market analysis for the output of the project to aid in business planning.

The scenario was successfully developed and formed the foundation for the simulated environment and the downwind hazard plume modeling. It consisted of three stages: a deliberate derailment of a train containing either methanol (flammable) or ammonia (caustic) cars at an overpass where the prevailing winds would either cause the plume to travel over the City Hall and the C-train tracks or over the Stampede grounds. The secondary event would be the deliberate release of chemical agent from a van parked near the train derailment and the tertiary event would be a giant fertilizer bomb in a van parked beside City Hall.

The support to developing the avatars and accurate equipment was hampered by the lack of availability of CEMA staff due to the June 2013 flood in Calgary and other continuing emergency problems, but LuomaTech Inc. contributed extensively to visits and discussions with Calgary CEMA representatives, and also identified an alternative source of expert information within the Calgary Fire Department who was able to help to develop the right behaviours for the avatars. Attempts to include Calgary Police Service participation were largely unsuccessful. Finally, LuomaTech Inc. acted as the project management lead at the beginning of the project and arranged/documented a number of team meetings in the first year of the project to ensure all issues and risks were addressed.

LuomaTech Inc. also contributed to the creation of the poster presented to the DRDC-CSS summer symposium in 2012 and also attended SecureTech in Ottawa in the fall of 2012 on behalf of the team. Unfortunately, the project did not proceed sufficiently quickly for LuomaTech Inc. to participate in additional presentations and publications, but a market survey and strategy was created for 3DInternet Inc. to aid in marketing the outcome of the project when it is complete.

Unfortunately, the outcome of the project is unlikely to reach a maturity level where it can be marketed without significant additional investment. However, the market survey and discussions with potential end users indicated the potential impact of the project on incident planning and response can be great. Currently, acceptable options do not exist in the market place – therefore this project is an excellent candidate for additional funding to advance the maturity of the simulation environment so that its value can be demonstrated in an operational environment.

6. Background (from Project Charter)

Since the terrorist attacks of September 11, 2001, and the subsequent establishment of the Chemical, Biological, Radiological-Nuclear, and Explosives (CBRNE) Research and Technology Initiative (CRTI), considerable efforts have been made to strengthen Canada's preparedness for, prevention of, response to, and recovery from threats to public safety and security. An important part of this effort involves development of planning and training tools for first responders in order to provide them with the knowledge, competence and confidence to deal with a wide spectrum of terrorist incidents that may involve CBRNE materials. At the present time, scenario-based training is limited to first responders' hands-on training (which includes live-agent field training) at Defence R&D Canada – Suffield (Counter Terrorism Technology Centre - CTTC) and other training offered by the Canadian Emergency

Management College (CEMC). Unfortunately, completing all levels of training is expensive, includes significant time away from normal duties, and is limited to a small proportion of the end-user community. Furthermore, the current curriculum does not utilize training in a simulated urban environment using realistic hazard scenarios. Thus, there is a significant capability gap/need in providing realistic training for all first responders, and the project addresses RAM (Risk Management), PCPS (Public Confidence and Psycho-social Behaviour Factors), and ESI1/ESI2 (Exploitation and Sustainment of Investments) of the CRTI investment priorities for Call 9.

In the CRTI 09-0509TD First Responders Immersive Training in a Simulated Environment (FRITSE) project, a game-based synthetic environment (SE) utilizing simulation technologies pioneered in the gaming industry was developed to address the major capability gap identified above. The objective was to develop a highly realistic game-based SE for incident commanders and first responders to conduct individual and/or team training and collaboration or response planning (at the tactical and/or strategic levels) to address deliberate or accidental CBRN releases in urban environments. This was achieved by integrating a physics-based urban flow/dispersion modeling system, a high-fidelity building-aware GIS representation of a real cityscape (Calgary) and a proven game-based simulation engine with expert input from first responders.

It is anticipated that this unique tool will allow individual and joint collective CBRN training that is focused, realistic, effective, challenging, and engaging to end users. The game-based SE can also be applied to enhance table top and command post exercises by providing an objective, dynamic, physically realistic virtual world (CBRN agents in a real cityscape) where one or more “players” (incident commander, first responder) can be immersed as humans-in-the-loop to interact with this virtual reality, allowing the recreation of scenarios that would be too expensive or too dangerous to implement in the real world. As new scenarios are built and implemented in the SE, the breadth and depth of virtual training, exercising, and prototyping opportunities will increase, adding additional value as emerging threats evolve or expand. Consequently, the output of this project (distributed multiplayer immersive game-based CBRN SE) represents a major new capability that is complementary to hands-on CBRN training.

The FRITSE project leaves behind a prototype of a game-based simulation and training package for a CBRN incident in an urban environment (Calgary) at a TRL 5 level. This would be the only product of its type offered in Canada for first responders and addresses a major capability gap in training for first responders to prepare for, prevent, respond to and recover from CBRN incidents in urban environments. Additional scenarios and urban environments will allow the product to impact a broad range of first-responder capability needs.

Within the project, LuomaTech Inc., led by Dr. Greg Luoma, was responsible for the original concept that led to the proposal. Once the proposal was accepted and funded, LuomaTech assumed the lead role in preparing the core scenario upon which the simulation was built. LuomaTech Inc. also contributed extensively to the development of accurate avatars, equipment and behaviours that were implemented in the game. Further, LuomaTech Inc. represented the project at a number of promotional opportunities and created an analysis and survey of the potential market for the output of the project. Finally, at the beginning of the project LuomaTech Inc. provided some project management services and capabilities to ensure that the team activities, schedules and risks were being addressed adequately.

Once the project was fully operating, LuomaTech Inc. also provided liaison with alternate first responder expertise and the project funders at DRDC-CSS to promote the project for follow-on opportunities.

This report outlines the contributions of LuomaTech Inc. to the successful completion of the project.

7. Objective (from Project Charter)

The overall objective of the FRITSE project was to develop a highly realistic, game-based and immersive simulation environment (SE) for first responders to allow them to conduct mission planning, distributed and interactive team training, and remote collaborations to address deliberate or accidental releases of CBRN materials in urban environments.

LuomaTech Inc. sub-objectives were to develop and deliver the basic scenario(s), contribute to the development of the simulation environment, provide support to promoting and commercializing the output, and undertake some project management and coordination activities.

8. LuomaTech Inc Work Tasks and Milestones (from Project Charter and PWGSC Contract W7702-125292/001/SV)

LuomaTech Inc. was the lead on two tasks and supported four others within the Charter. Note that these are different than the contractual obligations under PWGSC Contract W7702-125292/001/SV. The brief descriptions of the tasks from the Project Charter are as follows:

a. Work Tasks Completed by LuomaTech Inc.

- Task 2: Develop a portfolio of CBRN hazard scenarios (e.g., a derailment and explosion involving volatile chlorine tanker in downtown Calgary, etc.). All partners in the project will participate and the task will be led by LuomaTech Inc. (Dr Greg Luoma). The outcome of this task will be a portfolio of realistic CBRN hazard scenarios with the details (size of release, inflow wind direction/speed, location, expected response, etc.)
    - LuomaTech Inc. completed this task in June 2012 and delivered a multi-level scenario to the Project Manager.

- Task 6: Develop detailed avatars for incident commanders, emergency responders and potential terrorists, as well as entities for CBRN equipment (e.g., detectors, masks, etc.). 3DInternet Inc. (Mr Allan Doubinin) and CEMA (Mr Thomas Flowers, Mr Lindley Biblow) will collaborate on this task with support from LuomaTech Inc. (Dr Greg Luoma). The output of this task will be a series of avatars and entities for key first responders, including capabilities (CBRN equipment, communication networks) and roles. Also, additional avatars for by-standers, criminals, terrorist members and others will be included if required as part of the hazard scenarios formulated in Task 2.
    - Dr. Luoma attended numerous meetings at the Calgary Fire Hall with 3DInternet Inc. and helped to define avatars, equipment, and models for scenario; and,
    - Acted as assistant project manager to arrange formal meetings and opportunities for experts and team mates to exchange information.

- Task 7: Integrate the avatars developed in Task 6 with the simulation environment, test their fidelity, and modify as necessary. 3DInternet Inc. will lead with support from the other partners as required. The output of this task will be a "playable" game-based simulation environment with key first responder roles (and equipment for responders) accurately integrated, along with limited additional avatars.
    - Dr. Luoma worked with 3DInternet to develop the core simulation that was realistic;
    - Introduced the concept of using the simulation for planning purposes and bench top exercises in addition to training; and,
    - Brought in additional expertise from the Calgary Fire Department to support 3DInternet Inc.

- Task 8: Develop "what if" scenarios to add complexity and consequences for incorrect actions. LuomaTech Inc. (Dr Greg Luoma) will lead this task with support from other partners. The output will be additional scenario elements that enhance the realism of the "game" (Milestone 13)
    - These were discussed at several meetings with 3DInternet Inc. and CEMA.

- Task 12: Document and deliver leave-behind capability. The output will be deliverables, leave-behind capability and a "Highlight" sheet
    - A market survey was completed in October 2012 by Dr. Luoma; and,
    - A Highlight sheet was completed by LuomaTech in March 2013.

- Task 13: Participate in CRTI Symposium. 3DInternet Inc. and DRDC Suffield will lead
    - LuomaTech attended both the CRTI Summer Symposium and CADSI SecureTech in 2012 on behalf of the team; and,
    - Dr. Luoma attended numerous meetings both in Ottawa and Calgary with DRDC-CSS staff to discuss the progress on the project.

In addition to these defined tasks from the Project Charter, LuomaTech also participated in meeting organization and program management activities, in developing a market strategy and assessment, and in liaising with key experts from the Calgary Emergency Management Agency, Calgary Fire Department and Calgary Police Service.

b. Milestones Completed by LuomaTech Inc.

LuomaTech Inc. met three milestones associated with the tasks above that were defined in the PWGSC contract W7702-125292/001/SV to LuomaTech Inc. as the following:

- Milestone 1: Development of CBRNE scenarios (vignettes). Lead the development of a comprehensive portfolio of CBRNE hazard scenarios for the urban environment (each scenario must contain enough detailed information for a computer simulation of the scenario to be undertaken). This milestone was modified to be a single multistage event in Calgary that included a train derailment involving toxic volatile materials, a subsequent chemical agent release and a large explosion and approved by the Project Manager (June 2012).
    - This milestone was successfully met in June 2012 with the delivery of the scenario document to the Project Manager.

- Milestone 2: Advise on development/design of CBRNE equipment for synthetic environment. Provide technical expertise and input for the development and realistic representation of CBRNE equipment (e.g. detectors, masks, etc.) for use in the game-based simulation environment (June 2013).
    - This milestone was successfully completed in June 2013 through the various activities described above and detailed in the Results section below.

- Milestone 3: Contribute to preparation of presentations/papers for conferences/symposia. Provide input/support for presentations and/or technical papers prepared for various scientific meetings and symposia (including the annual Public Security S&T Summer Symposium (June 2014).
    - This milestone was successfully completed with the delivery of this document, attendance at the CRTI Summer Symposium in 2012, attendance at the CADSI SecureTech in 2012, and the preparation of the Highlights Document in 2013.

LuomaTech Inc. had three deliverables as described in the PWGSC contract which included:

- Bimonthly progress reports along with claims for incremental payments (all have been submitted)
- A portfolio of CBRNE hazard scenarios for an urban environment (completed July 2012)
- Final report (to be completed Jul 2014)

With the submission of this document, all of the deliverables have been completed and delivered to the Project Manager.

9. Results

As noted above, LuomaTech Inc. was the lead in the development of the scenarios for the project and supported 3DInternet Inc. in developing realistic avatars, equipment and behaviours for the avatars. LuomaTech Inc. also assumed additional project management duties in the early stages of the project, and attended some trade shows and symposia on behalf of the team. Finally, LuomaTech Inc. produced a market study and analysis for the project and a highlight sheet that was used to attempt to get additional first responder support for the project.

a. Task 2: Development of Scenarios

The first major task in the project was the development of the scenario(s) around which the simulation would operate. Since the Calgary Emergency Management Agency (CEMA) was a team member, the decision was taken to develop a scenario in The City of Calgary since that would allow the greatest input from CEMA in developing the avatars and response behaviours to drive the simulation. In consultation with other team members including the Project Manager, LuomaTech Inc. determined that one fundamental multiple stage event would be the best focus for developing a scenario which could then be varied based on the location of the event, meteorological conditions, time of day, and types of materials being released. The use of multiple stages would also allow the complexity of the event to be controlled and varied as the potential players become more capable.

It was determined that the best primary event for The City of Calgary would be a train derailment since the primary cross-country rail tracks for CP Rail pass directly through downtown Calgary, and the potential for either an accidental or deliberate derailment of trains carrying toxic materials in a densely occupied neighbourhood with excellent political targets is highest. The derailment would cause a major leak of either caustic (ammonia) or highly flammable (methanol) material from derailed tanker cars which would then impact major traffic arteries (e.g., C-Train or McLeod Trail), political targets (e.g., City Hall or Stampede Grounds) and densely populated office buildings. The seriousness and complexity of the primary event could be easily varied by adjusting the exact location of the derailment, the amount of material released, the wind direction, and the time of day. From a business development perspective the use of a train derailment also represents one of the highest probability accidental public safety and security events, so it serves as an excellent training or planning base even if the terrorist threat is low. The exact locations chosen for the primary event should remain confidential and will not be reported here. However, they were accurately defined in the deliverable report from this task.

The secondary event would be a deliberate release of chemical agent in the vicinity of the primary event timed to cause the greatest casualties among evacuating civilians and first responders. This would be the first clear indicator of a terrorist event. This event would involve a vehicle parked downwind and near the site of the primary event. It would be triggered remotely at a time 15-30 minutes after the primary event to produce a plume of a chemical agent that would travel downwind within the original area contaminated by the release of caustic or flammable material from the primary event. This would greatly increase the complexity of the response to the primary event and would focus on developing the specific expertise, experience and behaviours among the first responder community and response planners to deal with a terrorist event involving CBRNE agents. The key knowledge gained would be in early recognition of a CBRNE event and then implementing the correct responses and behaviours as quickly as possible to produce the best outcome using the appropriate protective equipment and protocols to limit casualties, contain the contamination and then remediate the site.

The third event would be the detonation of a large vehicle bomb within the general area of the first two events but targeted at a high political value site such as City Hall. The vehicle containing a fertilizer bomb would be remotely detonated after the area is fully occupied by first responders and people are leaving the building. The goal in this tertiary event is to maximize panic/chaos, produce a large number of civilian and first responder casualties, and create the greatest political statement. The tertiary event develops extensive skill and experience among the planners and first responders to address a large number of casualties concomitant with a reduced numbers of first responders, and would only be included in the scenario for the most advanced participants.

Three variables were introduced into the scenario to add richness and training options. They were location, meteorological conditions, and time of day. The precise locations and meteorological conditions are somewhat linked since the objectives were to place the events in locations that would provide downwind hazards to key political and highly populated areas. The time of day can be chosen to vary the numbers and types of casualties that are produced.

Two primary locations were identified based on accessibility and probability of producing the greatest effect. Trips to downtown Calgary were used to confirm the locations as appropriate for terrorist events based on the ability to access the locations without being noticed and the good line-of-sight access to the precise locations from numerous directions in order to choreograph the secondary and tertiary

events as the scenario unfolds in time. Exact details of the locations are not disclosed in this report for security reasons.

Two wind directions were selected based in part on the normal wind directions in Calgary. Essentially locations for the derailment and subsequent toxic release of chemical agent were linked primarily to southeasterly and southwesterly winds but an option for a north wind is also possible for one of the locations.

The primary time of day that was selected was just before the end of the business day in downtown Calgary. This time of day would produce the largest number of casualties and the greatest crowd control and transportation issues for response planners and first responders. Again, details are contained in the final scenario report but are not reported here for security reasons.

Numerous visits were made to the potential event sites to ensure that the criteria discussed above would be met, and the common wind directions for Calgary were also considered in determining the precise locations of the events. Environment Canada, a partner on the project, provided wind rose information for The City of Calgary that facilitated the selection of appropriate wind speeds and directions for the scenarios.

b. Tasks 6-8: Contributions to Avatar, Equipment and Behaviour Development, Simulation Development, and What If Scenarios

The development of the simulation environment and the components (avatars, equipment and behaviours) is being led by 3DInternet Inc. However, Dr. Luoma, because of the domain expertise he brings to the project in the area of CBRNE defence, participated in the development and implementation of equipment, avatars and behaviours.

A number of visits were made to Calgary No. 1 Fire Hall to see the various response vehicles that would be used by CEMA and determine that they were “typical” for an emergency response organization. These included fire trucks, hazard materials vehicles, other vehicles, the types of equipment that are in general use by first responder groups throughout Canada, and the specialized equipment that is available to first responder and emergency response organizations such as CEMA. In addition, detailed discussions were completed on the specific response protocols commonly used by first response organizations. These were translated into avatars and equipment representations in the simulation by 3DInternet Inc., while LuomaTech Inc. provided expert input on how the specialized CBRNE equipment is employed and the types of responses that can be expected when it is used. The goal of these discussions was to increase the realism when the equipment and avatars are created within the simulation environment.

In addition, LuomaTech Inc. coordinated a number of team meetings to discuss the 3D rendering of the area in downtown Calgary where the events occurred. A significant issue arose with respect to the accuracy of the existing 3D maps of the area and the impact on the downwind hazard calculations and plume modelling. The team ultimately decided to recreate the 3D map of downtown Calgary to ensure accuracy and realism in the rendering of the plume modelling data.

While participation of CEMA and the Calgary Fire Service was good, the team was lacking police participation in the project. In particular the simulation requires police participation in controlling crowds, coordinating responses and perhaps collecting forensic evidence. LuomaTech Inc. attempted to coordinate participation of a recently-retired senior police officer in liaising with the Calgary Police Service to gain support and additional participation in developing the scenario. A series of documents was provided to the police representative to be used in gaining support. Although the documentation was apparently effective in gaining support, participation of the police service continued to be an issue throughout the project.

During the development of the simulation environment, the availability of the CEMA participant(s) also became an issue due to the flood in Calgary. For a period of several months the CEMA representatives were fully engaged in the flood response and remediation so could not participate in the FRITSE project. As a result LuomaTech Inc. accessed additional expertise from within the Calgary Fire Department to aid 3DInternet Inc.in ensuring the accuracy of the scenarios rendered within the synthetic simulation environment.

LuomaTech Inc. also attended a number of meetings at 3DInternet Inc. to discuss how the simulation would be used and supported. During these sessions, numerous “what if” scenarios were discussed, as well as how to increase the utility of the simulation as both a training tool and a planning tool. These discussions led to significant changes in the way the simulation environment was being developed.

Finally, LuomaTech Inc. conducted a market analysis for the outcome of the project. This analysis was delivered to 3DInternet Inc., but will not be discussed in this report due to its proprietary content.

c. Tasks 12-13: Leave Behind Capabilities and Symposia Attendance

LuomaTech Inc. is not responsible for completing the main leave-behind capability which is the working prototype of the simulation environment. However, during the course of the project LuomaTech Inc. contributed a number of significant outputs which have been incorporated in the final product or which were used to guide development of the simulation environment.

First, the scenario developed by LuomaTech Inc. represents a highly realistic high probability scenario for a train derailment containing toxic materials in an urban environment. Since the scenario was developed, numerous train derailments (most notably the one in Lac Megantic) have confirmed the relevance of the scenario. Thus the scenario development leaves behind a highly developed scenario within the simulation for an event that is relevant both nationally and internationally. This scenario can be used for training and response planning to increase readiness to respond to future events. Second, the market analysis completed for the FRITSE project provides a platform for commercializing the outcome of the FRITSE program and similar projects within the public safety and security community. It identifies potential customers and approaches to commercialization that can be used beyond the current program. Third, highlight sheet provides a template for all public safety and security projects as a means to engage external stakeholders and users, and to inform them of important developments within the Canadian Safety and Security Program (CSSP).

LuomaTech Inc. also attended two relevant Symposia on behalf of the team, supporting the project manager at the CRTI Symposium in Ottawa in June 2012, and representing the project at the CADSI

Defence Security Symposium in Ottawa in October 2012. Both were well attended by public safety and security experts and first responders.

10. Milestones Completed (As Per Contract W7702-125292/001/SV)

The following milestones were achieved as described in the work plan:

Milestone	Date Planned	Date Completed	Achievement
Scenario Development	30 June 2012	4 July 2012	Scenario document delivered to Project Manager and was subsequently used in the development of the simulation, scenario developed to include "what if" options
Support to development of avatars, equipment and behaviours within the simulation environment	1 July 2012 – 30 June 2013	30 June 2013	Participated in trips to Fire Hall, provided meeting organization and project management services, coordinated hiring of Calgary Fire Department expert into project
Support to preparation of papers and attendance at symposia	1 July 2013 - 30 June 2014	30 June 2014	Prepared Highlight Sheet, provided input to poster and project review packages, attended CRTI Summer Symposium and CADSI SecureTech in 2012. Developed a market strategy document for 3D Internet Inc.
Preparation of Final Report	31 July 2014	30 July2014	Delivered to Project Manager by e-mail.

11. Deliverables (As Per Contract W7702-125292/001/SV)

LuomaTech had three deliverables as described in the PWGSC contract which included:

- Bimonthly progress reports along with claims for incremental payments (all have been submitted)
- A portfolio of CBRNE hazard scenarios for an urban environment (completed July 2012)
- Final report (to be completed 30 July 2014)

All deliverables have been provided to the Project Manager in electronic format on 30 July 2014.

12. Discussion and Recommendations for Future Work

While the LuomaTech Inc. led tasks and contributions achieved the desired objectives, milestones, and deliverables, they were small compared to the level of effort needed to achieve the primary outcome which was a working simulation environment for CBRNE first responder training. LuomaTech Inc.

believes that the overall outcome of the project has not reached the level of maturity that was hoped for at the outset. The main issues impacting success seemed to be an overly ambitious plan, the inability of CEMA representatives to participate at the level originally anticipated, and the difficulty in managing a project that included this many participants without a prime system integrator.

The potential value of the output remains high since the development of a simulation environment that allows accurate and realistic mission planning and training against a variety of terrorist or naturally-occurring events involving train derailments, toxic materials release, CBRNE agents, and other low probability but high consequence results remains a high need and priority for first responder groups. The marketing survey and discussions with a variety of potential customers confirmed that there will be a strong customer base for the product when it is complete. Recent tragic events involving train derailments (e.g., Lac Megantic) confirm the need for this capability.

The project plan was extremely ambitious, and numerous technical issues had to be overcome. First, the 3D rendition of The City of Calgary that was available to the team was inaccurate and had to be re-created before the downwind plume models could be completed. This caused a significant project delay that impacted the timing of other tasks within the plan.

Second, the amount and level of complexity of equipment was unexpected and a significant level of effort was required to accurately reproduce it all (including responses) within the simulation environment. Even more importantly, response protocols involving three (or four) distinctly managed first responder groups (fire, police, emergency management agency, and medical) had to be considered, so participation of CEMA alone was insufficient to meet the simulation requirements. Furthermore, CEMA was unable to access expertise in police and other services as had been anticipated at the start of the project so key expertise was not available to build the simulation.

Another key issue was how to effectively complete the development when there is a high need for the unique expertise and technical input from first responder groups that are not regularly available to participate in the development due to the nature of their jobs. In the current project, the level of interest from CEMA and other Calgary first responder groups was high throughout the project, but the participation level was low because of a number of emergencies and operational needs that greatly impacted their availability to participate in the project. Thus the project stalled for many months because the team could not advance the simulation without the input from subject matter experts on the protocols, tactics and behaviours of first responders responding to a natural or deliberate train derailment involving the release of toxic or flammable materials.

Finally, the way the project plan and individual contracts to the team members were established and managed produced a major challenge in coordinating efforts and managing the project. Originally, LuomaTech Inc. volunteered to help manage the project by organizing team meetings and maintaining lists of risks, issues, and action items, but the lack of authority to enforce due dates and deliverables as a true project manager made this role untenable. Further, the different priorities and attitudes of team members (a mixture of those that were interested in the scientific advance and those that were interested in producing a product) required prioritization of efforts that did not occur. As a result, meeting milestones and schedule due dates was not given enough priority and funding was insufficient to achieve the desired level of maturity of the outcome.

While the above suggests that the project achieved limited success in producing the desired outcome and value for the CSSP, interest and need for the FRITSE capability remains high. Thus it is worth continuing to pursue maturation of the output that will be delivered by 3DInternet Inc. at the end of the project. However, achieving success requires a more rigid project plan and structure driven by a project management structure that is focused on outcomes and accurately defines the roles and expectations of each team member. In addition, assured participation of subject matter experts must be achieved by including a partner that can access multiple experts within all first responder groups. If these conditions are met then the FRITSE project has a high probability of success in producing exceptional value for the CSSP and in addressing a major capability gap in the Canadian capability to plan and respond to terrorist events or accidental train derailments involving highly toxic or flammable materials in urban environments.

Appendix A: Highlight Sheet for FRITSE Project

CRTI 0509TD: First Responder Immersive Training in a Simulated Environment (FRITSE) Project

Start and End Dates: January 2012 – September 2014.

Background/Type of Project

- Previous experience in responding to major public safety and security events has suggested that the actions and quality of response in the first 30-60 minutes is critical in containing the scope of the disaster and in facilitating the best long term outcome. Mistakes made in the initial response are magnified as the incident progresses.
- Opportunities for realistic training against these types of events are severely constrained by cost, safety issues in staging live events, and availability of first responders to attend them.
- Alternatives to live field trials currently lack the realism and accuracy needed to simulate a real event and/or engage front line first responders.

Objectives of FRITSE

- Develop a highly realistic and accurate immersive simulation environment and core scenario to facilitate first responder training for deliberate or accidental large scale public safety and security incidents in urban environments that involve release of toxic materials and explosives.
- Provide a highly flexible and scalable first responder training simulation environment that facilitates customization and incorporation of a variety of scenarios and locations, using The City of Calgary as the initial scenario location for the prototype development.

Key Participants

- Sponsor/Funding Agency: Public Safety Canada/DRDC – Centre for Security Studies
- Lead Federal Agency: Defence Research and Development Canada (DRDC), Suffield Research Centre
- Lead Industry Partner: 3DInternet Inc.
- Other Partners: LuomaTech Inc., WATCFD, Calgary Emergency Management Agency (CEMA), Canadian Meteorological Centre (CMC) [Environment Canada]

Project Outputs

- A core simulation environment that realistically and accurately represents the real public safety and security incident, is engaging, and enhances the learning experience for first responders;
- A specific mature interactive training scenario for Calgary that incorporates:
    - Options for up to three levels of incident severity and complexity – a train derailment with release of moderate toxic materials in downtown Calgary; a follow-up deliberate release of highly toxic chemical agents near the original event; and a third event involving a major explosion at a major public facility near the first two events.
    - Options for multiple locations for incidents, and the ability to alter events on-the-fly.
    - An accurate downwind hazard model of the true hazardous area from each event.
- A flexible and scalable immersive simulation application that can accommodate a wide variety of scenarios, varying degrees of complexity, real time alterations to the incident, and be tailored to the specific high priority training needs of a variety of end user agencies; and,
- An on-line flexible application that accommodates a variety of readily available computing platforms (PCs, iPads, Android tablets, etc.), multiple simultaneous users, interaction with trainers and real time evaluation of performance.

Impact for First Responder Community

- More effective simulation-based training for a larger number of first responders against the most probable accidental or deliberate major public safety and security incidents;
- A low cost alternative to field training to enable more frequent and flexible options for scenarios while avoiding the safety issues associated with field trials;

- More accurate emergency response planning by allowing planners to simulate an incident and test response readiness; and,
- Potential to train against a wider variety of potential public safety and security incidents.

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