XIT Commercial Explosives Identification Tool

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IMPORTANT INFORMATIVE STATEMENTS

CRTI 08-0131TD Commercial Explosives Identification Tool (XIT) was supported by the Canadian Safety and Security Program (CSSP) which is led by Defence Research and Development Canada's Centre for Security Science, in partnership with Public Safety Canada. The project was led by National Research Council Information and Communication Technologies. Partners in the project include AMITA Corporation, CATSA, New Technology, Canada Border Services Agency Applied Research and Development Division, Natural Resources Canada Explosives Regulatory Division, Public Safety Canada, Royal Canadian Mounted Police CPC Explosives Training Unit, and Toronto Police Service, Explosives Disposal Unit.

CSSP is a federally-funded program to strengthen Canada's ability to anticipate, prevent/mitigate, prepare for, respond to, and recover from natural disasters, serious accidents, crime and terrorism through the convergence of science and technology with policy, operations and intelligence.

Abstract

This document represents the Project Completion Report for the Commercial Explosives Identification Tool (XIT) Project (CRTI 08-0131TD).

This project has transformed current disparate, often paper-based, information on commercial non-fireworks-related explosives and articles into a standardized electronic database. The delivered database serves as an efficient, searchable tool for access by selected law enforcement, intelligence, incident analysts and regulatory authorities.

The XIT Project addresses the following CRTI gaps: E1 (Consolidated explosives threat list), E4 (Post-blast scene investigations), NSIC2 (CBRNE attribution), and 'D&I4' (field identification methods for CBRNE agents/precursors).

XIT provides its authorized users with consolidated and detailed commercial explosive product information such as identification images, product brand/type, recognition elements (codes, colors, dimensions, quantity, etc.), explosives ingredients and packaging. The XIT Project developed a web enabled database system that is used as a 'tool' by law enforcement field operatives; to access a centralized extensive 'inventory'[1] of commercial explosives to assist in response to events involving explosives.

User roles include: search, data entry, and system administration. Users may access XIT via the internet. XIT is a tool designed to provide:

- Improved method to confirm the official classification of commercial explosives and attribute the source of the materials to a specific manufacturer
- Improved method for the inspector in the field to confirm identity and status of commercial explosives product based on an incomplete visual description
- Improved method for the investigator in the field to identify commercial explosives product based on a fragment found as part of the post-blast scene investigation
- A working business model for an authorized consolidated explosives threat list that may be shared by the intelligence gathering community

XIT was assessed by staff from CATSA, CBSA, NRCan Explosives Regulatory Division (ERD), PSCan, RCMP CPC Explosives Training Unit (ETU), Toronto Police Service (TPS) Explosives Disposal Unit (EDU), and a team from Carleton University's Human Oriented Technology Laboratory (HOTLab). Advice was also sought from the Canadian Explosive Industry Association (CEAEC). Exercise findings of usability, appropriateness, and operational utility are summarized in a formal Technical Demonstration Evaluation Report (WBS 5-1-3).

The success of XIT may be gauged from comments of stakeholders who have gone on record to say things from "XIT will be an invaluable tool for several sectors of the law enforcement field"

[1] Inventory is defined as "An itemized catalog or list of tangible goods or property, or the intangible attributes or qualities." http://www.businessdictionary.com/definition/inventory.html

(Gord Bevan, TPS EDU) to “The search methods and capabilities of this data base will provide great assistance for either routine or in-depth investigations involving explosives.” (Don Chenel, RCMP CPC ETU).

XIT is installed within the server environment of Shared Services Canada and is being used by NRCan ERD for evaluation purposes. The current operational readiness state of XIT is reflected in the comment “The database could not be labelled as 'extensive' in the generic sense i.e. minimal data for all types and minimal corresponding pictures.” (Deborah Taylor, NRCan ERD).

The beneficial impact of XIT includes the following:

- Speeds up investigations enabling the timely arrest of suspects or interdiction of future events
- Permits RCMP CBDC to conduct a more precise incident search with SOCIUS/CID to determine if the same products have been stolen or used in other incidents
- Permits ongoing education of inspectors to assist them in the identification of items of interest
- Improves public safety by reducing or eliminating the scope for misuse of commercial explosives.

The XIT Project was delivered within a fixed cost framework where priorities were ranked and delivered. Further development of key features is recommended in order to make XIT ready for full operational deployment.

Table of contents

List of Figures

List of Tables

Acknowledgements

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The Federal Lead was the National Research Council of Canada Information and Communication Technologies Portfolio (NRC-ICT) and had the involvement of the following agencies:

- AMITA Corporation
- CATSA, New Technology
- CBSA, Applied Research and Development Division
- NRCan Explosives Regulatory Division
- PSCan
- RCMP CPC Explosives Training Unit
- Toronto Police Service, Explosives Disposal Unit

Please refer to Annex A for contact names.

1 Introduction

This document represents the Project Completion Report for the Commercial Explosives Identification Tool (XIT) Project (CRTI 08-0131TD). Referenced hyperlinks are accurate at time of writing.

This project transforms current disparate, often paper-based, information on commercial non-fireworks-related explosives and articles into a standardized electronic database. The delivered database serves as an efficient, searchable tool for access by selected law enforcement, intelligence, incident analysts and regulatory authorities.

The XIT Project addresses the following CRTI gaps: E1 (Consolidated explosives threat list), E4 (Post-blast scene investigations), NSIC2 (CBRNE attribution), and 'D&I4' (field identification methods for CBRNE agents/precursors).

XIT provides its authorized users with consolidated and detailed commercial explosive product information such as identification images, product brand/type, recognition elements (codes, colors, dimensions, quantity, etc.), explosives ingredients and packaging.

XIT is a tool designed to provide:

- Improved method for the inspector in the field to confirm identity and status of commercial explosives product based on an incomplete visual description
- Improved method for the investigator in the field to identify commercial explosives product based on a fragment found as part of the post-blast scene investigation
- Improved method to confirm the official classification of commercial explosives and attribute the source of the materials to a specific manufacturer
- A working business model for an authorized consolidated explosives threat list that may be shared by the intelligence gathering community

This operational concept emerged out of the work with the XIT partners. The original proposal focused on the outputs to the first responders in the field while the fleshed out model includes the interaction between manufacturer and regulator. It recognizes the value of maintaining the consolidated data for the regulators as well as the field users.

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The operational concept model is reflected below in Figure 1.

Figure 1: XIT Operational Concept

2 Purpose

This project addresses CRTI gaps E1 (database on commercial explosives) and E4 (improve management and analysis of data within post-blast scene investigations). Often post-blast investigators recover detonator leg-wires, partial explosives wrapping & residues that may be analyzed on-site to indicate the chemical nature of the explosives. This information is sent to the NRCan-ERD and others, where personnel conduct a manual search of manufacturers' brochures and specification sheets. This can take several days; delaying the investigation. This situation will be remedied by XIT's capability of readily identifying commercial explosives, given incomplete information based on the recovery of remnants of the illegally-used explosives product in the fabrication and initiation of an improvised explosive/CBRN device.

Through inclusion of foreign-manufactured explosives, XIT will support criminal and national security investigations by expeditiously providing attribution/country of origin information as per CRTI Priority NSIC2 (CBRNE attribution).

Addressing 'D&I4', the resulting knowledge base of XIT can be used for training and delivering hazard prevention information to others such as personnel within the emergency tri-services, CBSA (Canadian Border Security Agency), DND (Department of National Defence), CATSA (Canadian Air Transport Security Authority), the US ATF (Bureau of Alcohol, Tobacco, Firearms, and Explosives), the intelligence community, and NRCan.

XIT also builds on previous CRTI project methodologies/technologies (e.g. CBRNE Incident Database (CID) was created in CRTI-04-0047TD and enhanced in CRTI-06- 0236TA.).

Please refer to Annex D for details on CRTI Investment Priority Areas.

3 Methodology

The project involved the definition / creation / installation of a bilingual, commercial explosives database system populated by NRCan ERD with existing data from their library. The project included the creation and delivery of users/system administrator training packages followed by a six-month technical demonstration with fine tuning/revision of XIT as needed. The database system is server-based and internet accessible with secure access provided to the database of commercial explosives.

The software release methodology for the technical demonstration release of XIT was based upon time-boxing the top priority requirements as part of the first release. Time-boxing is a very effective method to foster discipline and respect for time and resources on a project.[2] The technical requirements were also included in the scope setting of the first release in addition to the functional requirements. Further releases will be able to build on these prioritized requirements which were re-evaluated at the start of the second release.[3]

As per the project charter, the final deliverable of the project was to leave behind an installation of XIT that will be available to all project participants. For practical user demonstration purposes, in Version 1, the technical team focused on streamlining data collection to create a very user friendly application. For Version 2, special consideration was given to functionality to search the XIT database (as per Statement of Work WBS-4-1-7). Version 2 included the ability for the System Administrator to maintain the codes used for efficient data capture and structured search. The focus was on the ease of identification by the end user in the field. The end user seeking to identify their findings is given a "neutral expert" solution that allows them to search for images of products in XIT that match their field observations. XIT provides results in such a manner that the end user doesn't need to understand the material composition or the chemical behavior of metals, simply what the commercial explosive and/or components looks like.

The XIT project followed a five phase plan:

- Phase 1 – Project Definition and Planning
- Phase 2 – Requirements and Survey
- Phase 3 – Design and Development Version 1 XIT
- Phase 4 – Technical Demonstration and Version 2 XIT Development
- Phase 5 – Project Close Out

A description of each phase is included below.

Phase 1 – "Project Initiation and Planning":
The objectives of this phase were to assemble the project team, develop appropriate project management planning documents and to initiate project activities. The detailed description of

[2] XIT WBS-1-1-2 Project Management Plan, Section 5 – "Development of XIT proceeds using a "time-box" methodology (fixed calendar time and resources, functionality is prioritized to fit within time-box, functionality that does not fit within the time box is not built)"
[3] XIT WBS-1-1-2 Project Management Plan, section 7.5.

the scope of work was included in the Project Management Plan. The phase also included a survey of existing NRCan information.

Phase 2 – "Requirements and Survey":
During this phase, efforts were directed towards collection of XIT functional, technical and interoperability requirements through a series of consultation workshops conducted with the project partners. Key objectives of this phase were to identify and define the architecture, the interoperability requirements and the user needs analysis in preparation for the interface design of XIT.

Phase 3 – "Design and Development Version 1 XIT":
Based upon the requirements identified in Phase 2, this phase focused on the creation of detailed technical specifications for XIT Version 1 and the subsequent development and testing of the system. In addition, AMITA developed user aids and conducted training sessions with the XIT Version 1 support and user community.

Phase 4 – "Technical Demonstration and Version 2 XIT Development":
XIT was installed on server(s) within NRCan ERD for the technical demonstration period. Search oriented records were created from a spreadsheet table of current manufacturer products containing classification, identification and external characteristic values. Lists of codes were derived from these records to allow quick update of entries and structured search requests. Images and publications were added by NRCan ERD and the contents were indexed to create a consolidated search oriented record. AMITA updated XIT related specifications based on feedback for changes that were collected and prioritized for XIT Version 2 based on the technical demonstration period. This phase included design, development, testing and deployment of XIT Version 2.

Phase 5 – "Project Close Out":
The project concluded with a 3 month support period, the demonstration evaluation report and project close-out activities. The "leave-behind" version of XIT and availability of the software (source) and training was provided to NRCan ERD. XIT remains a production site at NRCan-ERD.

4 Results

Global CBRNE (Chemical Biological Radiological Nuclear and Explosives) threats are creating pressure to be more efficient in emergency response and preparedness to reduce risks to the Canadian public. However, bombing incidents are considered high impact/low frequency events. A tool specialized to what are considered 'low frequency' events would pose significant challenge to successful and timely user adoption. XIT is designed for any emergency scenario where identification of commercial explosives is required - it goes beyond meeting the needs of bombing incidents.

This section includes:

- Result Summary
- Project Champion's Observations
- Project Manager's Observations
- Project Team Observations

4.1 Result Summary

This project transformed what was disparate, often paper-based, information on commercial explosives and articles into a standardized electronic database. It delivered an efficient, searchable tool in the form of a database accessible by selected law enforcement, intelligence, incident analysts and regulatory authorities. It provides this community of practice with consolidated and detailed commercial explosive product information such as identification images, product brand / type, recognition elements (codes, colours, dimensions, quantity, etc.), explosives ingredients and packaging. The information contained in XIT is based on the pool of information held by the NRCan ERD within the Explosive Safety and Security Branch (ESSB). XIT is designed to provide rapid analysis and identification of commercial explosives products from incomplete descriptions.

This project delivered a near real-time capability to perform commercial explosives typing and to support explosives attribution, in addition to an in-depth analysis tool for the use of regulatory authorities and intelligence, security and law enforcement investigators. The project focused first on streamlining data collection to create a very user-friendly system based on NRCan ERD requirements. XIT provides consolidated commercial explosive information, supplied by manufacturers, that is currently held by NRCan ERD. For the TD project, we focused on current non-fireworks commercial explosives. XIT Leave Behind resides with ERD and remains accessible (at time of writing) by regulatory, law enforcement, intelligence and security agencies.

The tool represents a highly innovative capability that meets a well-defined and critical requirement to identify commercial explosives based on a partial description or fragment.

The team believes the tool to be user friendly, easy to learn, and useful to everyday tasks. We firmly believe that XIT will considerably improve the ability for inspectors and investigators to identify a commercial explosive found in the field.

The project has succeeded in meeting its objectives and partners agree that the XIT System demonstrated value. XIT provides:

- Improved method to confirm NRCan ERD classification of commercial explosives
- Improved method to confirm identity and status of commercial explosives product based on an incomplete visual description
- Improved method to identify commercial explosives product based on a fragment found at the scene of an incident
- A working business model for providing authorized consolidated explosives threat list that may be shared by the intelligence gathering community

In terms of outputs, the XIT System was demonstrated to provide the following:

- Structured database of non-firework commercial explosives currently available in Canada
- Internet access with tiered-security access to the detailed data
- Automated tools are provided to enable searching and aid maintenance of data as new commercial explosives are introduced each year
- Extensive Search capability that may improve response to criminal and terrorist use of commercial explosives

How to sustain the system as part of day-to-day operations remains under review by NRCan.

4.2 Project Champion's Observations

During the final Project Review Committee Meeting of the project, our Project Champion, Dr. Andrew Reddick:

- Recommended that the DRDC CSSP program develop a model to support private-public partnerships for sustainability;
- Recommended that the CSSP program mandate partners in future projects to use the technology developed in training and operations;
- And recommended that the CSSP program proactively support efforts to ensure interoperability of technologies with government systems.

These activities would be of great value in enhancing the uptake potential of XIT within the Defence community.

4.3 Project Manager's Observations

This project was destined to be a success primarily because of the commitments made by the partners.

The participants were very supportive in terms of integration and acceptance of XIT. The police community agreed that the tool would be useful on an every-day basis but requested a comprehensive set of images be included. CBSA indicated they could not see officers using XIT if content is restricted to current high explosives products – they requested the data be expanded to include fireworks and obsolete and/or prohibited products.

The long term value of XIT is in its potential for interoperability with other Emergency Management initiatives in a System of Systems approach between the law enforcement field operatives and NRCan ERD.

4.4 Project Team Observations

The XIT tool was assessed by staff from NRCan ERD, NRC, the RCMP CPC ETU, TPS EDU, CATSA, CBSA, and a team from Carleton University's Human Oriented Technology Laboratory (HOTLab). Advice was also sought from CEAEC association. Exercise findings of usability, appropriateness, and operational utility are summarized in a formal Technical Demonstration Evaluation Report (WBS 5-1-3).

4.4.1 Advisors

The project was challenging from both a technical and content perspective.

The Technical Team collected the user requirements identified by the partners and through an iterative development process created a tool capable of delivering fast identification and in-depth analysis tool for the use of regulatory authorities and intelligence, security and law enforcement investigators. As a result, XIT is flexible and adaptable as an authorized source of consolidated data on commercial explosives.

4.4.2 Technical Team Perspective

Evaluation of the system revealed several key technical considerations as detailed in the following sections.

4.4.2.1 Ease of Use Considerations

Results of the usability inspection of the user interface (heuristic evaluation) by the Carleton University HOTLab are summarized in working notes presented to the software development team. Many of these key modifications to enhance usability have been successfully included in XIT by the technical team in the second version of the software system.

From a technical point of view, XIT is user-friendly. Pick-lists and clear definition of terms contributes to ease of use. Search Users have indicated a willingness to be part of a user group where pick-list values may be further refined.

Proficiency in XIT use comes with minimal training but requires an ongoing commitment on the part of participating law enforcement agencies to provide orientation to new users on the search criteria that describe the commercial explosives product. Including XIT as part of integrated training and exercises as part of the Communications Interoperability Strategy for Canada (CISC)

would allow participating agencies to appreciate the benefits and advantages of XIT as part of this initiative.

4.4.2.2 Industry Best Design, Development Practices, and Open Standards

The acquisition and selection process of open standard and open source de facto standard infrastructure software for XIT considered a large, mature, and wide-spread technical community to be a critical selection factor. This ensures direct access to a deep pool of inherent knowledge associated with the infrastructure tools of choice.

XIT development was predicated on well-known implementation patterns for the Model View Controller architecture including, but not limited to, the following:

- Object to relational mapping patterns
- Data access objects patterns
- Enterprise business logic patterns

Technologies contributing to both cost efficiency and functionality include:

- Enterprise Java Beans – stateless beans for web (local or remote) interaction
- Apache Lightweight Directory Access Protocol – for storage and access of user information
- Extensible Markup Language (XML) – for fast and reliable data and document storage
- Hibernate Object Relational Mapping tool – provides flexibility in designing an effective web application and portability to other relational database management systems
- SmartGWT Tag Library – provides fully functional web based component library

XIT is compliant with:

- Interface / protocol open standards for interoperability (e.g. Java, Apache Lucene).
- Open standards data repository (e.g. XML).

The XIT project leveraged a highly mature and proven set of technologies to solve the need for a web based tool with no background software license costs. XIT is a Java / J2EE based smart client application implemented within a SmartGWT web framework for the Google Web Tools (GWT) wrapper.

XIT includes a smart client application that allows the user's local application to interact with server-based application through the use of Web services.[4]. The smart client provides the following characteristics:

- Rich user interface that takes advantage of the power of the browser on a personal computer desktop
- Connect to the centralized server which maintains the database and data exchange services
- Uses local storage and processing resources to enable operation during periods of no network connectivity or intermittent network connectivity
- Ability to be deployed and updated in real time over the network from a centralized server making it easy to deploy and configure

4.4.3 End User Perspective

XIT presented users with a wealth of features and approaches to viewing data. In general, the user experience reported from the technical demonstrations was positive and input for many new features has been captured and recorded for future consideration in guiding both research and tool design.

A key concern was the need for more images. During training roughly 20% of product details, included images and in October2012 the percentage is now more than 30% and growing. The RCMP CBDC investigator, who primarily deals with post blast as well as recovery, indicated images were of high value. TPS EDU and NRCan ERD Inspector agreed that the display grid of product images in the search results is the most useful aspect of XIT. It is important to note that images much be high quality to be useful and that the placeholder images that are sometimes used in XIT must be upgraded.

Collectively all project partners reported their project involvement as a positive experience.

4.4.3.1 TPS EDU

The point of contact provided the following observation in Newsletter #4.

> *I believe that the XIT Project will be an invaluable tool for several sectors of the law enforcement field. Prior to its creation and upcoming implementation, it would have taken a great deal of time and effort to acquire this information, as nothing like it currently exists. Investigators and bomb squad officers will have vast amounts of information at their fingertips. Once fully deployed and populated, it will greatly enhance the ability to trace the remnants of a post-blast scene. Keeping the database up to date is essential, as new products are consistently being developed and marketed in Canada. It will also serve as a great reference tool for officers to keep up to speed on what is commercially available, as any of these products may be encountered by various agencies across the country. As with any project of this complexity, training and fine-tuning of the product is critical. I wholeheartedly endorse the continuation and development of this project.*

[4] http://www.webopedia.com/TERM/S/smart_client.html

4.4.3.2 RCMP CPC ETU

The point of contact provided the following observation in Newsletter #3.

> *This information platform will augment quite significantly explosives identification and recognition. The search methods and capabilities of this data base will provide great assistance for either routine or in-depth investigations involving explosives.*

During the final evaluation he indicated:

> *The AMITA team has done tremendous work in designing and ascertaining that XIT becomes user friendly and operational*

4.4.3.3 NRCan ERD

The point of contact provided the following observation in Newsletter #1.

> *As the regulator of the Canadian Explosives Act and Regulations controlling the manufacture, importation, storage and sale of commercial explosives (including fireworks, pyrotechnics and ammunition), NRCan' s Explosives Branch welcomes the consolidation of detailed commercial explosives product information in a searchable query engine that will greatly assist law enforcement in identifying explosives.*

During the final evaluation she indicated the importance of including images for each product:

> *The database could not be labelled as 'extensive' in the generic sense i.e. minimal data for all types and minimal corresponding pictures.*

4.5 Project Assumptions, Constraints, Administration, Contracting, and Risk Factors

The following are key assumptions, constraints, administration, contracting, and risk factors identified in the project charter that have been significant factors in this project.

Type of Factor	Description in Charter	Impact
Assumption	That all project team members will be available to perform their assigned tasks when required.	Schedule proceeded as described in Contract with minor deviations. See Annex B.2
Assumption	That the technical staff and other resources including test equipment, scientific resources and other facilities such as all laboratories as provided by the various partners will be available to perform required tasks and research when required and as committed.	Implemented as described in Contract.

Type of Factor	Description in Charter	Impact
Assumption	That the XIT potential users will willingly participate in the project implementation, as necessary.	Schedule proceeded as described in Contract with minor deviations. See Annex B.2
Assumption	Development of XIT will proceed using a "time-box" methodology (fixed calendar time and resources, functionality will be prioritized to fit within time-box, functionality that does not fit within the time box will not be built).	Several change requests were not included. The only outstanding requirements considered mandatory in the Requirement Traceability Matrix is the ability for user to view usage statistics. See WBS-5-1-3 Evaluation Report for details. Workaround is for NRCan to prepare its own report using the audit logs.
Constraint	XIT will be developed using Open Standards software tools.	Implemented as described in Charter.
Constraint	XIT will be developed to be interoperable with other systems to become one system in a system-of-systems environment.	See Lesson Learned section below on Interoperability
Constraint	XIT architecture will be designed to minimize the use of 3rd party suppliers that charge license fees to ensure that XIT is affordable.	Implemented as described in Charter.
Risk	Key risks in this TD project are not gaining operational acceptance / usage (intelligence analysis / law enforcement / border agents and the Canadian explosives industry). The non-acceptance risk will be mitigated by placing XIT in production-ready state at NRCan-ESSB. This concretely demonstrates to the user community the system's ease-of-use and ease-of integration. XIT also includes 'Help' features. To mitigate the cost perception, open-source architecture is targeted (low / zero cost). NRC will provide particular expertise to assist AMITA in their creation of a user-friendly system.	Mitigated as described in Charter.
Risk	"Status quo" risk must also be recognized. By doing nothing, there is sustainability-risk in the paper records approach. NRCan content / information experts will not always be in place, thus compromising explosives information	**Not** mitigated as described in Charter – i.e. **No** "data load" mechanisms were developed since the estimated volume of 20 updates a year did not

Type of Factor	Description in Charter	Impact
	capability. XIT will significantly reduce this risk. The industry may perceive that XIT conformance will be resource-intensive. The project team will mitigate this risk by engaging the Canadian explosives industry from the outset, and designing reasonable "data load" mechanisms to encourage their ongoing support in keeping data current.	justify this approach. See Lesson Learned section below on NRCan content / information experts.
Risk	Within the operational community risk may occur if XIT is: • perceived to require extensive user skills • costly to procure • Difficult to implement within existing systems / processes The project will include an economical, sustainable method of keeping XIT updated in partnership with industry. XIT will be designed for production deployment and use after project completion. The results are a ready-to-use database and system deployable and accessible by authorized intelligence officers, law enforcement officials, customs agents and investigators anywhere in Canada.	Partially mitigated as described in Charter. Tool is provided free of charge to Federal Departments. There are no 3rd party software license fees. User interface did include features to allow for efficiency in data capture like the ability to duplicate a product detail record. NRCan ERD has indicated they propose to link XIT to their Products Authorization System in order to create a low cost and sustainable solution within their organization.

4.6 Lessons Learned and Benefits to Canada

4.6.1 Interoperability Requires Shared Governance Structure

The Safecom Continuum is a recognized authority in terms of providing guidance to Canadian jurisdictions[5] that are pursuing a new interoperability solution, based on changing needs or additional resources.[6] In this section, XIT is contrasted to key aspects of the Continuum as a means to identify the respective maturity of XIT interoperability within the Police Explosives Technician community and Explosives Products Regulatory community.

[5] Canadian Interoperability Technology Interest Group, or CITIG, http://www.inter-op.ca/en/industries/government.html
[6] Source: SAFECOM Interoperability Continuum

Governance

Governance involves the establishment of a common framework to promote the reduction of traditional impediments to achieve interoperability including: jurisdictions, policies, practices and communication.

Although historically in Canada, relations between police and regulatory authorities are cordial, there is no governance between the RCMP CBDC and NRCan ERD with regards to the collection, consolidation or sharing of technical data. Instead, product related data is casually (informally) shared.

Currently the RCMP CBDC uses the SOCIUS product for the collection of hazardous device incidents, as well as the collection of theft and recovered explosives, although there is no mandate for other Canadian Explosive Disposal Units (EDU) to contribute (share) data with the RCMP CBDC.

NRCan could potentially use XIT to provide useful data to the law enforcement community but the common framework to promote this must still be established.

Standard Operating Procedures

Standard Operating Procedures (SOP) typically have both operational and technical components. Established SOPs enable emergency responders to coordinate an incident response across disciplines and jurisdictions. Clear and effective SOPs are essential in the development and deployment of any interoperable communications solution.[7]

In the context of the commercial explosives identification by first responders, the common standard operating procedures pertain to the collection of Forensic evidence. This is out of scope for the XIT Project.

XIT will provide the participating police agency with the capability to search for an appropriate product based on the perceived composition and configuration of a device component. The product data would then be available to any system participating in a data sharing agreement with the governance authority.

Technology

XIT generates files that a user could transfer to another application. This meets the lowest level of interoperability as specified by the Continuum. It could provide a technical approach consistent with mature 'Data Elements' strategies as described in the Continuum. Strategies such as: one-Way Standards-Based Sharing enabling applications to broadcast (push) or receive (pull) information from disparate applications or data sources; and Two-Way Standards-Based Sharing permitting the sharing of information from disparate applications and sources to process information, building on the attributes of other solutions.

Training and Exercises

In the context of the SAFECOM Interoperability Continuum, Training and Exercises pertains to implementing effective programs to 'practice communications interoperability' to ensure that the communication technology works during emergencies.

[7] Source: SAFECOM Interoperability Continuum, Standard Operating Procedures

Having access to XIT via a field portable platform will permit on-site real-time searches of XIT. The type and nature of the data maintained by the system readily lends itself in the advancement of training programs for the Police Explosive Technicians.

Usage

The Continuum refers to 'Usage' as how often deployed technologies are used. XIT is specific for commercial explosives activities. Its usage can be applied to any event where a commercial explosive poses a threat to responder or public safety, becoming part of the standard kit for police explosive technicians.

As indicated in the charter, XIT directly relates to and is interoperable (on a business and technical level) with several previous and present CRTI funded projects. For example RCMP CBDC operates the SOCIUS system (originally funded by CRTI) that manages the collection and aggregation of CBRNE incident data within Canada. Both XIT and SOCIUS capture a significant amount of information that can be used together to help different agencies of government in CBRNE preparedness, prevention or response. They lay the foundation for a 'system-of-systems' approach. The synergistic nature of these systems and the information they contain can help improve our national preparedness as they provide the building blocks to synchronize efforts between various agencies and all levels of government.

For investigators to best utilize the search and analysis capabilities of SOCIUS, they must have a complete detailed technical understanding of the device(s) used in the incident. Often criminals will use commercial explosives for improvised CBRNE devices and, frequently, they will break up the product or use portions of it. Similar break-up of the product may occur during the application of device disruption techniques by bomb technicians or in situations when the device explodes but does not fully initiate / destroy the entire explosives load (low order). If the investigator cannot quickly identify the altered / partial explosives product this may impede the investigation. Waiting for 5-7 days to have a manual search and identification of the original product may jeopardize the success of an investigation. XIT creates a tool for police investigators to take incomplete information on commercial explosives in CID and link it to the possible originating product(s).

4.6.2 Employed International Best Practices

The challenges faced by other countries and perceived weaknesses in their implementations highlighted pitfalls that the Project avoided in the design and development of XIT. Valuable features employed as international best practices include:

International best practices	XIT Status
1. Product classification	Included
2. Search capability	Included
3. Importing/exporting data	Included export to spreadsheet
4. Security	Included restricted access by role
5. Reporting	Included ability to print grid results to output device
6. Interoperability	Included ability to generate XML table or print files that could be uploaded to classified systems such as SOCIUS/CID
7. Ease of accessibility	Included support for access using popular

International best practices	XIT Status
	commercial Internet browsers (e.g. IE, Firefox, Chrome)
8. Simple, streamlined user interface	Included
9. Ease of navigation	Included

These features offer powerful capabilities and opportunities for the XIT technical demonstration and/or future versions of the tool. Moreover, there is room for Canada to improve on and circumvent obstacles experienced by our international peers.

Key messages for XIT included:

- Focus on Core Competencies described in the Purpose section of this report (i.e. E1 – Consolidated explosives threat list, E4– Post Blast Scene investigations, and 'D&I4' Field identification methods for CBRNE agents/precursors
- Keep user interfaces and navigation simple and easy to use
- Facilitate quick, easy access to data and images
- Ensure the tool is equally effective for emergency preparedness and operational response, within the context of explosives regulation

A preliminary task for the Technical Team in preparation for requirements gathering was to perform a high level market scan to identify international solutions that could be leveraged (WBS-2-1-2 Survey Related Applications). The primary findings of the survey are summarized below:

Observation	Recommendation	XIT Status
System requirements for a unique identification label specified in the EU Directive 2008/43/EC and related Guidance from FEEM 1. Name of manufacturer 2. An alpha numeric code identifying the member state, manufacturer, product code identification	The name of manufacturer and product code should be included in the database design for future interoperability with the European Union directive.	Included product name, manufacturer name, and shipping name of product
Contact with the Bomb Disposal Centre managers and the Police Force officials within the global community resulted in only a few responses. We found only paper based systems are currently in use. The limited response appears to indicate that this type of communication is politically sensitive in nature and should be made at a higher level within	We recommend this result be reviewed by the XIT Project Management Committee and alternative approaches be considered.	EU BDC reviewed Version 1 with obvious interest. AMITA's offer to engage in further talks has met with no response.

Observation	Recommendation	XIT Status
the governance structure.		
While we did find related applications (i.e. Introva Tracking, ORDATA, and CHEMATIX), there are few details readily available to assist the XIT designers. Whether or not these applications could serve potential interoperability targets remains unclear.	We recommend AMITA pursue direct contact with the vendors for these applications during requirements gathering and design phases to discover pertinent details (e.g. lessons learned, applicable standards, potential for interoperability, etc.).	ORData Search was used as a baseline for design of advanced search. No direct contact has been made with other vendors.

Concepts originating in these preliminary reviews were subsequently translated into application presentations allowing the user team to further visualize the application and make improvements before any software development took place.

4.6.3 NRCan content / information experts may not always be in place

As per charter: "Status quo" risk must also be recognized. By doing nothing, there is sustainability-risk in the paper records approach used at NRCan ERD. NRCan content / information experts will not always be in place, thus compromising the ability to share explosives information with law enforcement community. XIT will significantly reduce this risk."

Mitigation as per Charter: "The industry may perceive that XIT conformance will be resource-intensive. The project team will mitigate this risk by engaging the Canadian explosives industry from the outset, and designing reasonable 'data load' mechanisms to encourage their ongoing support in keeping data current."

Discussions with Canadian Explosives Industry Association (CEAEC) during requirements gathering (WBS-2-1-3) led to the above mitigation being abandoned. It became clear that the volumes were quite low for non-fireworks explosives (i.e. 20 updates a year). The user interface does include features to allow for efficient data capture like the ability to duplicate a product detail record.

A large number of product records must still be updated by NRCan with related images and documents (WBS-5-1-3). NRCan ERD has indicated one of their experts will continue part time to update XIT until the end of March 2013. A larger concern is the development of an economical sustainable method to keep XIT up-to-date beyond the end of the project - NRCan ERD are in the process of seeking funding to link XIT to their Products Authorization System.

4.6.4 Internet Accessibility

XIT is housed and maintained within the server environment of Shared Services Canada.

As part of the Project Kickoff, it was decided to de-scope the original proposal to have XIT widely distributed and installed in the field due to lack of funds. The ability to operate standalone on a personal computer was stipulated as out of scope in the requirements (WBS-2-1-3). This was

requested by the users during exercises and recommended as a future initiative in the TD Evaluation Report (WBS 5-1-3).

4.6.5 Value Outside Canada

In August 2012, the US Bureau of Alcohol/Tobacco and Firearms (ATF) indicated to NRCan ERD that they do not have a software application "widely used for commercial explosive identification. However, we have had programs in the past, and we have some wish list items." NRCan has a solid working relationship with ATF and the two organizations often share information. How XIT fits within the NRCan ATF relationship will require further investigation by NRCan.

EUROPOL has a similar initiative currently underway and has expressed interest in XIT. Version 1 was demonstrated to Europol representatives in March 2012 and the representatives perceived synergies they would like to pursue. Their approach differs in that they are engaging manufacturers directly and they have requirements from their forensic laboratories to include commercial explosives ingredients and analytical data e.g. spectroscopy print-outs/spectrum maps.

4.6.6 Potential Benefits

Several benefits are expected once NRCan makes XIT fully operational.

XIT will improve public safety by reducing or eliminating the scope for misuse of commercial explosives. Regulators (e.g. NRCan ESSB) may use XIT to confirm classification of a product.

XIT will permit ongoing education and assist in the identification of items of interest. It is important that personnel employed with CBSA, CATSA, and police forces recognize explosives products that they encounter during their inspections. Explosives products such as detonating cord and detonator assemblies are not labelled "EXPLOSIVES" and may not be recognized as being a threat / risk.

XIT will speed up investigations enabling the timely arrest of suspects or interdiction of future events. This is made possible through expedited awareness of the identity of the explosives product which permits authorities to conduct more targeted enquiries with the "product" manufacturer, retailer and industry users to determine if there have been recent purchases or thefts.

XIT will permit RCMP CBDC personnel to conduct a more precise incident search with SOCIUS/CID to determine if the same products have been stolen or used in other incidents. The quality and utility of incident reports on CID will be enhanced by linking the explosive that is used in an incident to the respective XIT record, permitting investigators to view detailed images and specifications of the product.

5 Transition and Exploitation

5.1 Follow-On R&D Recommended

CRTI 08-0131TD has produced a tool for bilingual operational use. The project demonstrated the feasibility of XIT; however, the team recommends further review by NRCan ERD, RCMP CPC ETU, and AMITA in order to make XIT ready for full operational deployment.

During requirements gathering, business requirements were formulated and proposed as either: important, highly desirable, or desirable. They were gathered with a broad based approach.

Training sessions and stakeholder demonstrations where the XIT concept was showcased proved valuable as the positive response from the wide ranging audience further validated the work of the team. These sessions also served to help understand, from the stakeholder' perspective, the links between other projects and how they could work together.

The Technical Team addressed the important requirements and highest ranked change requests as top priorities. The time box approach was effectively applied to ensure the highest ranked changes were made but a substantial number of change requests remain outstanding – please see WBS-5-1-3 TD Evaluation for details. The Evaluation Report recommended the following functionality be given top priority in any future R&D effort for XIT:

- Collect and View Usage Statistics
- Search using approximate values as criteria
- Search in standalone mode on mobile device
- Search for Fireworks products that are prohibited
- Search for 'old' (i.e. obsolete) product information

Partners have indicated the following may also add value:

- Include a 'classified data' restricted search level for regulator's use
- Maintain multi-agency participation by police and fire departments nation-wide
- Search by scanned image (image recognition)
- Directly update XIT from the ESSB Authorization Database
- Use searcher's location as sensor - alert if unusual search activity level detected in geographic area

5.1.1 Business Partnering

Through its existing business relationships, as well as through potential new channels identified in the evaluation process, AMITA is and will be pursuing business partnerships with companies based in Canada and abroad that have a global reach in terms of the potential for introducing XIT around the world. They may have an interest in further developing XIT.

5.1.2 Related CRTI Projects

As discussed above in Lessons Learned, interoperability with other systems remains a challenge.

The Charter identified the following related projects:

1. CRTI 06-0204RD: XIT was viewed to be an excellent fit with the Improvised Explosive Assessment Tool (IEAT). Since commercial explosives may be used / altered in the manufacture of some improvised explosives preparations, or as a booster to initiate them, having a link from an improvised explosives preparation to the XIT record of the commercial explosives precursor will provide investigators with information that can be followed up with during investigations. Tim Patraboy, at Public Safety, investigated and indicated this statement is incorrect. No link is required.
2. CRTI 06-317TD: The field portable PROBE Crime Scene Investigation and Support Tool platform could be used to permit on-site real-time searches of XIT. The status of PROBE remains unclear – its priority for additional funding is under review by CRTI.
3. CRTI-06-0236TA: IED-CID remains in progress and has indicated they may want XIT to interoperate with the CID implementation of SOCIUS/CID at the RCMP CBDC. Details remain unavailable at this time.

5.1.3 Identifying Funding Sources

5.1.3.1 Canadian Safety and Security Program (CSSP)

The CSSP "is a federally-funded program, which has been allocated $43.5 million dollars annually. The program's mandate is to strengthen Canada's ability to anticipate, prevent, mitigate, prepare for, respond to, and recover from natural disasters, serious accidents, crime and terrorism through the convergence of science and technology (S&T) with policy, operations and intelligence. The CSSP is delivered by the Defence Research and Development Canada's Centre for Security Science (DRDC CSS), a joint endeavour with Public Safety Canada."[8]

A proposal may be submitted by any Canadian private, academic or public sector organization.

NRCan ERD submitted a proposal-synopsis to CSSP on October 5, 2012 requesting $1.5 million in funding. Request for full proposals will be announced on November 5, 2012 with a closing date of December 5, 2012. Project award date is scheduled for February 2013.

5.1.3.2 Defence Industrial Research Program (DIRP)

The purpose of DIRP is to support the strategic research interests of the Canadian Forces and to introduce new and innovative technologies into the Department of National Defence. The program supports and complements the areas of science and technology (S&T) expertise associated with Defence R&D Canada and is designed to stimulate research and innovation among the Canadian defence and security industrial base through the provision of cost-shared contracts and scientific support. This year, the DIR Program is a six million dollar cost-shared

[8] http://www.drdc-rddc.gc.ca/drdc/en/media-room-salle-des-medias/news-releases-communiques-de-presse/backgrounder-documentation/

program that contracts eligible R&D projects at a fifty percent (50%) sharing ratio to a maximum contribution of $500,000.[9]

A proposal may be submitted by any incorporated Canadian company.

5.2 Intellectual Property Disposition

No issues were raised during the XIT project regarding Intellectual Property (IP) in software, methods or practices. The IP has been managed as described in the CRTI Call for Proposals: Guidebook for Fiscal Year 2008-2009 and the Implementation Guide for the Policy: Title to Intellectual Property Arising under Crown Procurement Contracts.[10]

Ownership of the Background Intellectual Property (BIP) remains as defined in the Project Charter:

- WorldReach.Net and A-Frame architectures are the IP of AMITA Corp. The Project Management Framework, Software Engineering Methodology, and ISO 9001 Quality Management System are the property of AMITA Corporation.
- The IP in pre-existing briefings or other knowledge transfer tools including minor changes/additions for the project will remain with the author (e.g. briefings on explosive classification models, project management principles).
- The IP developed as a result of this project resides with AMITA Corporation.

NRCan owns the information in the XIT database and a licence to use it is planned to be in place with AMITA when the project is completed to allow it to be used outside the project.

5.3 Public Information Recommendations

One of the primary tasks of the Centre for Security Science (CSS) is to enable and foster partnerships across departments and agencies in the Government of Canada, and among federal, provincial, and municipal levels of government, private-sector industry, academia, and responder and operational communities. The role of the Public Security Technical Program (PSTP) in this task is to reach out to potential partners involved in the PSTP mission areas and provide a forum through which the partners can develop into Communities of Practice.

Four newsletters have been produced and distributed during the XIT project. Distributing the final newsletter to the Canadian Association of Chiefs of Police may be an effective way to announce that XIT is ready for review by the broader community of practice. NRCan ERD indicated[11] they could make the arrangements to distribute product information to the police agencies if requested by the Project Review Committee.

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[9] http://www.drdc-rddc.gc.ca/drdc/en/partner-partenariat/prog/defence-industrial-research-program/

[10] A copy of the policy is available on the Treasury Board Secretariat (TBS) Web site at http://www.tbs-sct.gc.ca/pubs_pol/dcgpubs/Contracting/siglist_e.asp.

[11] September 20th, 2012Quarterly Meeting, item 8

6 Conclusion

The XIT project successfully applied a technical solution to an identified problem. Often criminals will use commercial explosives for improvised CBRNE devices and, frequently, they will break up the product or use portions of it. Similar break-up of the product may occur during the application of device disruption techniques by bomb technicians or in situations when the device explodes but does not fully initiate / destroy the entire explosives load (low order). If the investigator cannot quickly identify the altered / partial explosives product this may impede the investigation. Waiting for 5-7 days to have a manual search and identification of the original product may jeopardize the success of an investigation.

XIT is a tool designed to provide:

- Improved method for the inspector in the field to confirm identity and status of commercial explosives product based on an incomplete visual description
- Improved method for the investigator in the field to identify commercial explosives product based on a fragment found as part of the post-blast scene investigation
- Improved method to confirm NRCan ERD classification of commercial explosives and attribute the source of the materials to a specific manufacturer
- A working business model for an authorized consolidated explosives threat list that may be shared by the intelligence gathering community

The visual search tool represents an innovative capability that meets a well-defined and critical requirement to identify a product base on a fragment or partial description. The team believes the tool to be user friendly, easy to learn, and useful for everyday tasks. The team firmly believes that XIT will considerably improve the ability for inspectors or investigators to identify commercial explosives.

We recommend further development of key capabilities in order to make XIT ready for full operational deployment (e.g. ability to view usage statistics, search history, and automatic import of product details). A significant number of new requirements were identified by the team throughout the project development and a balance was sought between changes that could be made and changes that were beyond stated scope.

Annex A Project Team

The project partners are identified at Table 1: XIT Project Team below.

Table 1: XIT Project Team

Project Position	Name	Title	Phone Number	E-Mail Address
Project Champion	Dr. Andrew Reddick	Director, NRC	(506) 444-0540	Andrew.reddick@nrc.ca
Project Manager	Dr. Susan O'Donnell	Senior Research Officer, NRC	(506) 444-0374	susan.odonnell@nrc.ca
Portfolio Manager	Mr. Marc Roy	Portfolio Manager, Forensics Cluster Centre for Security Science DRDC	(613) 944-8168	Marc.Roy@drdc-rddc.gc.ca
Deputy PM	Mr. Sonny Lundahl	VP, Research and Development AMITA Corporation	(613 742-6482	Sonnyl@amita.com
Core Partner	Ms. Deborah Taylor	Senior Project Manager NRCan - ERD	(613) 941-4061	Deborah.Taylor@NRCan-RNCan.gc.ca
Partner	Mr. Timothy Patraboy	Senior Scientist PSCan	(613) 842-1492	patraboyt@smtp.gc.ca
Partner	Dr. Pierre Pilon	Research Scientist Research & Development Division CBSA	(613) 954-4112	Pierre.pilon@cbsa-asfc.gc.ca
Partner	Mr. Ron McAdam	General Manager, New Technology, CATSA	(613) 949-0501	Ron.McAdam@catsa.gc.ca
Partner	Sgt. Don Chenel	NCO i/c RCMP -Canadian Police College – Explosives Training Unit	(613) 993-4566	Don.chenel@rcmp-grc.gc.ca
Partner	Const. Gordon Bevan	Training Constable Toronto Police Service EDU	(416) 808-3831	Gordon.bevan@torontopolice.on.ca

Annex B Project Performance Summary

B.1 Technical Performance Summary

The functional capabilities built into XIT include the ability for field operatives to:

- Confirm NRCan ERD classification of commercial explosives
- Confirm identity and status of commercial explosives product based on an incomplete visual description
- Identify commercial explosives product based on a fragment found at the scene of an incident

This project addresses CRTI gaps E1 (database on commercial explosives) and E4 (improve management and analysis of data within post-blast scene investigations). Often post-blast investigators recover detonator leg-wires, partial explosives wrapping and residues that may be analyzed on-site to indicate the chemical nature of the explosives. This information is sent to the NRCan-ESSB and others, where personnel conduct a manual search of manufacturers' brochures and specification sheets. This can take several days; delaying the investigation. This situation will be remedied by XIT's capability of readily identifying commercial explosives, given incomplete information based on the recovery of remnants of the illegally-used explosives product in the fabrication and initiation of an improvised explosive/CBRN device.

Through inclusion of foreign-manufactured explosives, XIT will support criminal and national security investigations by expeditiously providing attribution/country of origin information as per priority NSIC2.

Addressing 'D&I4', the resulting knowledge base of XIT can be used for training and delivering hazard prevention information to others such as personnel within the emergency tri-services, CBSA (Canadian Border Security Agency), DND (Department of National Defence), CATSA (Canadian Air Transport Security Authority), highway inspectors, the US ATF (Bureau of Alcohol, Tobacco & Firearms), the intelligence community, and NRCan.

The technical performance of XIT is summarized in Table 2: XIT Capabilities.

Table 2: XIT Capabilities

Capability	XIT Project Target	Attained
(E1)	This project addresses CRTI gaps E1 (database on commercial explosives).	Success: Full Rationale: XIT contributes to a requirement for a consolidated explosives threat list by providing a database on commercial explosives, with a view to coordinating and furthering federal and other national efforts in this field. It provides users with consolidated and detailed commercial

Capability	XIT Project Target	Attained
		explosive product information such as identification images, product brand / type, recognition elements (codes, colors, dimensions, quantity, etc.), explosives ingredients and packaging.
(E4)	This project addresses CRTI gap E4 (improve management and analysis of data within post-blast scene investigations). Often post-blast investigators recover detonator leg-wires, partial explosives wrapping & residues that may be analyzed on-site to indicate the chemical nature of the explosives. This information is sent to the NRCan-ESSB and others, where personnel conduct a manual search of manufacturers' brochures and specification sheets. This can take several days; delaying the investigation.	Success: Full Rationale: XIT provides the capability of readily identifying commercial explosives, given incomplete information based on the recovery of remnants of the illegally-used explosives product in the fabrication and initiation of an improvised explosive/CBRN device.
(NSIC2)	Through inclusion of foreign-manufactured explosives, XIT will support criminal and national security investigations by expeditiously providing attribution/country of origin information as per priority NSIC2.	Success: Full Rationale: XIT includes foreign-manufactured explosives. Expeditiously provides attribution/country of origin information as part of manufacturer name.
(D&I4)	Addressing 'D&I4', the resulting knowledge base of XIT can be used for training and delivering hazard prevention information to others such as personnel within the emergency tri-services, CBSA, DND, CATSA, highway inspectors, the US ATF (Bureau of Alcohol,	Success: Full Rationale: XIT can be used for training and delivering hazard prevention information to others such as personnel within the emergency tri-services, CBSA, DND, CATSA, highway inspectors, the US ATF (Bureau of Alcohol, Tobacco & Firearms), the intelligence community, and NRCan.

Capability	XIT Project Target	Attained
	Tobacco & Firearms), the intelligence community, and NRCan.	

B.2 Schedule Performance Summary

The CRTI Project Initiation Workshop was held on April 16-17, 2009. The Charter was approved in December 2010 with an amendment on March 22, 2011. The contract was in place on March 1, 2011 with a planned duration of 20 months to complete planned deliverables by the end of October 2012; and a contract period of 25 months to accommodate unforeseen obstacles.

All 82 milestones were completed by the project close-out in March 2013.

Only the requirement specification (#15) and data model assessment (#18) needed significant revisions after completion to reflect decisions made after HOTLab Final Prototype / Report (#44). This is detailed in Table 3: Major Project Milestones.

Table 3: Major Project Milestones

Milestone Number	WBS Code	Task	Planned Completion Date	Actual Completion Date	Last Revision Date
1	1-1-1	Monthly Project Management	28-Feb-11	30-Nov-10	n/a
2	1-1-1	Monthly Project Management	28-Feb-11	31-Dec-10	n/a
3	1-1-1	Monthly Project Management	28-Feb-11	31-Jan-11	n/a
4	1-1-2	Project Management Plan	28-Feb-11	31-Jan-11	
5	1-1-3	Project Scope & Success Criteria	28-Feb-11	31-Jan-11	
6	1-1-4	Preliminary Exploitation & Sustainability Plan	28-Feb-11	31-Jan-11	
7	1-1-5	Survey NRCan Data	28-Feb-11	31-Jan-11	
8	1-1-6	Design Goals and Constraints	28-Feb-11	31-Jan-11	
9	1-1-7	Development & Environment Setup	28-Feb-11	31-Dec-10	
10	1-1-8	Participate in Opportunity & Risk Management	28-Feb-11	30-Jan-11	
11	1-1-9	Community Building (Newsletter/Abstract #1/ Project Website)	28-Feb-11	31-Jan-11	
12	2-1-1	Monthly Project Management	28-Feb-11	28-Feb-11	n/a
13	2-1-1	Monthly Project	31-Mar-11	31-Mar-11	n/a

Milestone Number	WBS Code	Task	Planned Completion Date	Actual Completion Date	Last Revision Date
		Management			
14	2-1-2	Survey Related Applications - Options Analysis and Recommendation	28-Feb-11	31-Jan-11	
15	2-1-3	Requirement Specifications	30-Apr-11	30-Apr-11	
16	2-1-4	XIT Interoperability Specification	31-Mar-11	31-Mar-11	
17	2-1-5	XIT Technical Architecture (incl PDR NRC IIT))	30-Apr-11	30-Apr-11	
18	2-1-6	Data Model Assessment	31-Mar-11	31-Mar-11	
19	2-1-7	Community Building (Newsletter/Abstract#2 / Prep/Attend CACP Conference)	31-Mar-11	31-Mar-11	
20	2-2-1	HOTLab User Needs Analysis (Incl T&E Plan)	31-Mar-11	31-Mar-11	
21	2-2-2	HOTLab Community Building (id Papers/Conference)	31-Mar-11	31-Mar-11	
22	3-1-1	Monthly Project Management	30-Apr-11	30-Apr-11	n/a
23	3-1-1	Monthly Project Management	31-May-11	31-May-11	n/a
24	3-1-1	Monthly Project Management	30-Jun-11	30-Jun-11	n/a
25	3-1-1	Monthly Project Management	31-Jul-11	31-Jul-11	n/a
26	3-1-1	Monthly Project Management	31-Aug-11	31-Aug-11	n/a
27	3-1-1	Monthly Project Management	30-Sep-11	30-Sep-11	n/a
28	3-1-1	Monthly Project Management	31-Oct-11	31-Oct-11	n/a
29	3-1-1	Monthly Project Management	30-Nov-11	30-Nov-11	n/a
30	3-1-1	Monthly Project Management	31-Dec-11	31-Dec-11	n/a
31	3-1-1	Monthly Project Management	31-Jan-12	31-Jan-12	n/a
32	3-1-2	Update Project	30-Apr-11	30-Apr-11	

Milestone Number	WBS Code	Task	Planned Completion Date	Actual Completion Date	Last Revision Date
		Management Plan			
33	3-1-3	Detailed Technical Specifications (incl CDR (NRC IIT))	31-May-11	5-Jul-11	
34	3-1-4	Test & Verification Plan	31-May-11	29-Jul-11	4-Jan-12
35	3-1-5-1	Central Library	31-Aug-11	27-Oct-11	
36	3-1-5-2	Fixed Site Access	31-Aug-11	2-Dec-11	
37	3-1-6	Test Version 1	30-Nov-11	12-Jan-12	30-Jan-12
38	3-1-7	Prepare User Aids	30-Nov-11	4-Dec-11	
39	3-1-8	XIT Deployment Packages (incl RTR)	31-Dec-11	28-Dec-11	02-Feb-12
40	3-1-9	User Training	31-Jan-12	31-Jan-12	
41	3-1-10	Community Building (Newsletter/Abstract #3)	30-Jun-11	9-Jan-12	
42	3-2-1	HOTLab Initial UI Design	30-Apr-11	30-Jun-11	
43	3-2-2	HOTLab Iterative Usability Tests and Evaluation	30-May-11	18-Jan-12	
44	3-2-3	HOTLab Final Prototype / Report	31-Oct-11	18-Jan-12	
45	4-1-1	Monthly Project Management	28-Feb-12	28-Feb-12	n/a
46	4-1-1	Monthly Project Management	31-Mar-12	31-Mar-12	n/a
47	4-1-1	Monthly Project Management	30-Apr-12	30-Apr-12	n/a
48	4-1-1	Monthly Project Management	31-May-12	31-May-12	n/a
49	4-1-1	Monthly Project Management	30-Jun-12	30-Jun-12	n/a
50	4-1-1	Monthly Project Management	31-Jul-12	31-Jul-12	n/a
51	4-1-2	Ready for Deployment of XIT V1 to NRCan ERD	31-Jan-12	31-Jan-12	
52	4-1-3	Migrate/Convert Data Support	31-Jan-12	31-Jan-12	
53	4-1-4	Rollout XIT Access to Partners	28-Feb-12	22-Feb-12	
54	4-1-5	Formal XIT Demonstrations	28-Feb-12	28-Feb-12	

Milestone Number	WBS Code	Task	Planned Completion Date	Actual Completion Date	Last Revision Date
55	4-1-6	Support Technical Demonstration	28-Feb-12	28-Feb-12	n/a
56	4-1-6	Support Technical Demonstration	31-Mar-12	31-Mar-12	n/a
57	4-1-6	Support Technical Demonstration	30-Apr-12	30-Apr-12	n/a
58	4-1-6	Support Technical Demonstration	31-May-12	31-May-12	n/a
59	4-1-6	Support Technical Demonstration	30-Jun-12	30-Jun-12	n/a
60	4-1-6	Support Technical Demonstration	31-Jul-12	31-Jul-12	n/a
61	4-1-7	Change Validation document	30-Apr-12	30-Apr-12	
62	4-1-8	Update XIT Specifications	31-May-12	31-May-12	
63	4-1-9	Update Test & Verification Specifications	31-May-12	31-May-12	
64	4-1-10	Build XIT Version 2	30-Jun-12	31-May-12	
65	4-1-11	Test XIT Version 2	30-Jun-12	8-Jun-12	
66	4-1-12	Final XIT Test Report	30-Jun-12	27-Jun-12	
67	4-1-13	Update User Aids	30-Jun-12	31-Jul-12	
68	4-1-14	Update XIT Deployment Package	30-Jun-12	15-Jun-12	27-Jun-12
69	4-1-15	Ready for Deployment of XIT V2 to NRCan ERD	31-Jul-12	8-Jun-12	27-Jun-12
70	4-1-16	Rollout XIT V2 Access to Partners	31-Jul-12	11-Jun-12	30-Jun-12
71	4-1-17	Deliver XIT Version 2 User Training Session	31-Jul-12	31-Jul-12	
72	4-1-18	Community Building (Newsletter/Abstract #4)	31-Jul-12	31-Aug-12	25-Sep-12
73	5-1-1	Monthly Project Management	31-Aug-12	31-Aug-12	n/a
74	5-1-1	Monthly Project Management	30-Sep-12	30-Sep-12	n/a
75	5-1-1	Monthly Project Management	31-Oct-12	31-Oct-12	n/a
76	5-1-2	Technical Support for Leave Behind	31-Aug-12	31-Aug-12	n/a
77	5-1-2	Technical Support for	30-Sep-12	30-Sep-12	n/a

Milestone Number	WBS Code	Task	Planned Completion Date	Actual Completion Date	Last Revision Date
		Leave Behind			
78	5-1-2	Technical Support for Leave Behind	31-Oct-12	31-Oct-12	n/a
79	5-1-3	Demonstration Evaluation Report	31-Oct-12	30-Sep-12	
80	5-1-4	Close-out Report	31-Oct-12	20-03-2013	
81	5-1-5	Success Story	31-Oct-12	31-Oct-12	
82	5-2-1	HOTLab - Community Support	31-Oct-12	20-03-13	

B.3 Cost Performance Summary

The project has been executed on time within budget. Total project funds to be expended (CRTI funds and in-kind contributions) during this Project were $2,351,373. Total CRTI funds expended during this project were $ 1,489,673. Project funds were administered by the Lead Federal agency, National Research Council Canada. Actual expenditures are detailed below.

B.3.1 CRTI Expenditures

Project Inception to 31 October 2012: $1,489,673.00

- FY 2010 – 2011: $ 305,512.00
- FY 2011 – 2012: $ 718,745.00
- FY 2012 – 2013: $ 465,416.00

B.3.2 In-Kind Reported

Project Inception to 31 March 2012: $ 861,700.00 (36.6%)

- FY 2010 – 2011: $305,450.00
- FY 2011 – 2012: $434,870.00
- FY 2012 – 2013: $121,380.00

Annex C. List of symbols/abbreviations/acronyms/initialisms

Terminology definitions are identified at Table 4: Abbreviations, Acronyms, and Initialisms below.

Table 4: Abbreviations, Acronyms, and Initialisms

Term	Definition
BIP	Background Intellectual Property
CATSA	Canadian Air Transport Authority
CBRN	Chemical, Biological, Radiological, Nuclear
CBRNE	Chemical, Biological, Radiological, Nuclear, Explosive
CBDC	RCMP Canadian Bomb Data Centre
CBSA	Canada Border Services Agency
CEAEC	Canadian Explosive Industry Association
CID	CBRNE Incident Database running at the CBDC
CISC	Communications Interoperability Strategy for Canada
CRTI	CBRNE Research and Technology Initiative
CSS	Centre for Security Science
DND	Department of National Defence
DRDC	Defence Research and Development Canada
EDU	Explosives Disposal Unit
GWT	Google Web Tools
HOTLab	Human Oriented Technology Lab (Carleton University)
IP	Intellectual Property
NRCan ERD	Natural Resources Canada, Explosives Regulatory Division belongs within NRCan ESSB
NRCan ESSB	Natural Resources Canada, Explosive Safety and Security Branch (ESSB)
NRC-IIT	National Research Council Canada - Institute for Information Technology
PROBE	PROBE –Crime Scene Support Tool for Police, Hazmat & EMS CRTI-06-0317TD is another CRTI project directly related to this project.
PSCan	Public Safety Canada

Term	Definition
R&D	Research and Development
RCMP CPC ETU	Royal Canadian Mounted Police, Canadian Police College, Explosives Training Unit
S&T	Science and Technology
SOCIUS	AMITA commercial brand name for tool originally developed as part of CRTI-04-0047TD CBRNE Incident Database (CID)
SOP	Standard Operating Procedure
TBS	Treasury Board of Canada Secretariat
TD	Technical Demonstration
XIT	Commercial Explosives Identification Tool
TPS	Toronto Police Service
US ATF	United States Department of Treasury, Bureau of Alcohol, Tobacco, Firearms, and Explosives
V2	XIT Version 2 released in June 2012
WBS	Work Breakdown Structure
XML	Extensible Markup Language

Annex D. List of Referenced CRTI Investment Priority Areas

CRTI investment priority areas referenced early in this document are identified in Table 5: Referenced CRTI Investment Priority Areas (source: CRTI-M-2008-1).

- CRTI Priority E1 (Consolidated explosives threat list)
- CRTI Priority E4 (Post-blast scene investigations)
- CRTI Priority NSIC2 (CBRNE attribution)
- CRTI Priority D&I4 (field identification methods for CBRNE agents/precursors)
- CRTI Priority Exploitation of previous CRTI investments

Table 5: Referenced CRTI Investment Priority Areas

General Priority Area	Deliverable Outcome Expected	CRTI 2008/2009 Specific Priorities – Technologies and Capabilities of Interest
Explosives – Threat and Capabilities	The desired projects will address or contribute to capabilities in the following priorities areas. In particular, the CRTI is looking for projects filling the identified gaps for each specified priority.	**E 1. Threat Intelligence** Projects that contribute to enhanced intelligence gathering methods, analysis and understanding of explosives and explosives precursors as threat agents. Also sought are projects that will identify best practices in explosives-related threat assessments. The CRTI is seeking proposals that will contribute to a requirement for a consolidated explosives threat list (such as a database on commercial explosives and devices), inclusive of attractiveness rating to potential perpetrators, with a view to coordinating and furthering federal and other national efforts in this field. Finally, projects are sought that contribute to the physical security of explosives, including monitoring the source, movement and use of explosives and certain precursors, as well as ergonomic and organizational considerations
		E 4. Responder Requirements Projects that will address responder performance improvements through lighter equipment, integrated protective

General Priority Area	Deliverable Outcome Expected	CRTI 2008/2009 Specific Priorities – Technologies and Capabilities of Interest
		systems, integrated response platforms, remote monitoring of responder performance and other performance issues. Also sought are projects that support post-blast scene investigation, through sample analysis, data collection and management, scene reconstruction modeling, and other related issues. Finally, projects that address responder Improvised Explosives Device Defeat (IEDD) technology, tools, techniques and procedures are sought.
National Security Investigation Capabilities	This priority would convey to members of the science and technology community the acute need for projects specifically related to supporting successful investigations of CBRNE pre-incident and post-incident conditions, in the field as well as the laboratory. Such activities would specifically refer to criminal and national security investigations, two distinct types of work with formal structures, conditions and separate ranges of possible outcomes under federal law. There is also a need to identify CBRNE-specific forensic techniques, improving on conventional techniques that are not applicable in such environments.	**NSIC 2.** Development of intelligence gathering (pre-incident) and Forensic (post-incident) methods, investigational tools and technologies that support the detection, identification and attribution of CBRNE hazardous material to source Develop innovative methods to **attribute** CBRNE materials: to a specific geo-location in the world; manufacturing method indicating likelihood of source location; whether the quality of the source material indicates professional or amateur production.
Detection and Identification	Further to the objectives stated above, the desired projects will address or contribute to expertise and capability in the following areas. In particular, the CRTI is looking for projects filling the identified gaps for each specified priority.	**D&I 4:** Identification Methodologies Develop innovative laboratory-based approaches and new technologies, methodologies for the sampling, measurement and analysis and results reporting in the analysis of CBRNE agents and precursors, including Special Nuclear Materials.

General Priority Area	Deliverable Outcome Expected	CRTI 2008/2009 Specific Priorities – Technologies and Capabilities of Interest
		Methods for the identification of CBRNE agents and precursors which are delivered directly in the field. These approaches should consider exploitation of common generic procedures and protocols readily adaptable to field teams. Methods focused on higher sample through-put, direct sample analysis, improved sensitivity. Develop innovative methods to **attribute** CBRNE materials: to a specific geo-location in the world; manufacturing method indicating likelihood of source location; whether the quality of the source material indicates professional or amateur production.
Exploitation of previous CRTI investments	This category is to attract proposals that either specifically define attempts to exploit previous CRTI investments. By exploitation, we mean moving it along the Technology Readiness Level. If the concept relates to priorities in this call for proposals then they should be submitted under that specific priority and not under this category. If however, the initial investment was made under a previous call and under a priority that is not part of call 8 then the concept should be submitted here. We [at CRTI] are particularly interested in proposals that can bridge across clusters, portfolios and threat domains.	**Exploitation** Exploitation of previous CRTI investments.