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Chief Review Services Chef - Service d'examen

CRS  CS Ex

Evaluation of the Chemical, Biological,
Radiological-Nuclear and Explosives (CBRNE)
Research and Technology Initiative (CRTI)

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Acronyms and Abbreviations

AAFC	Agriculture and Agri-food Canada
ADM(S&T)	Assistant Deputy Minister (Science and Technology)
AHRA	All-Hazards Risk Assessment
AP	Technology Acquisition (Project)
ARGOS	Accident Reporting and Guidance Operational System
BC	British Columbia
C2SM	CBRN Crime Scene Modeler
C4I	Command, Control, Communications, Computers and Intelligence
CAHSN	Canadian Animal Health Surveillance Network
CBRN	Chemical, Biological and Radiological-Nuclear
CBRNE	Chemical, Biological, Radiological-Nuclear and Explosives
CBSA	Canada Border Services Agency
CF	Canadian Forces
CFIA	Canadian Food Inspection Agency
CIP	Critical Infrastructure Protection
CNPHI	Canadian Network for Public Health Intelligence
COP	Communities of Practice
CPRC	Canadian Police Research Centre
CRS	Chief Review Services
CRTI	CBRNE Research and Technology Initiative
CSIS	Canadian Security Intelligence Service
CSS	Centre for Security Science
DG	Director General
DHS	Department of Homeland Security
DND	Department of National Defence
DoD	Department of Defense
DPR	Departmental Performance Report
DRDC	Defence Research Development Canada
DSTPS	Director S&T Public Security
EC	Environment Canada
EMA	<i>Emergency Management Act</i>



EMSI	Emergency Management & Systems Interoperability
FNEP	Federal Nuclear Emergency Plan
FY	Fiscal Year
GoC	Government of Canada
HAZMAT	Hazardous Material
HC	Health Canada
IEG	Intelligence Experts Group
MECSS	Major Events Coordinated Security Solutions
Med Post	Medical and Casualty Management Command Post and Temporary Treatment Center
MOU	Memorandum of Understanding
NRC	National Research Council
NRCan	Natural Resources Canada
OPI	Office of Primary Interest
OGD	Other Government Department
PAA	Program Activity Architecture
PCO	Privy Council Office
PHAC	Public Health Agency of Canada
PMB	Program Management Board
PriMer	Psychosocial Risk Manager
PSAT	Public Security and Anti-Terrorism
PS	Public Safety Canada
PSST PMB	Public Security S&T Program Management Board
PSST SC	Public Security Science and Technology Steering Committee
PSTP	Public Security Technical Program
Pstp	Public Security Technical Program
PWGSC	Public Works and Government Services Canada
R&D	Research and Development
RCMP	Royal Canadian Mounted Police
RD	Research and Technology Development (Project)
RN	Radiological-Nuclear
RPP	Report on Plans and Priorities
S&T	Science and Technology



SA	Science Advisor
SARS	Severe Acute Respiratory Syndrome
SC	Steering Committee
SII	Surveillance, Intelligence and Interdiction
SPG	Strategic Planning Guidance
TA	Technology Acceleration (Project)
TAG	Technical Advisory Group
TBS	Treasury Board Secretariat
TC	Transport Canada
TCL-C	Target Capability List – Canada
TD	Technology Demonstration (Project)
TRL	Technology Readiness Level
UK	United Kingdom
US	United States



Results in Brief

This evaluation was conducted to assess the relevance and performance of the CRTI during the current five-year funding period (fiscal year (FY) 2007/08 to FY 2011/12), as a pre-condition to program funding renewal in 2012. For this funding period, the Public Security and Anti-terrorism (PSAT) funding of CRTI was approved at \$35 million per year for a total of \$175 million.

The CRTI involves 22 federal departments and agencies that are concerned with public safety and security issues. Through a Memorandum of Understanding (MOU) between the Department of National Defence (DND) and Public Safety Canada (PS), the CRTI is jointly led through the Defence Research and Development Canada (DRDC) Centre for Security Science (CSS). The CSS is designated as one of nine research centres within DRDC.

Through the development of federally led science cluster networks, the CRTI brings together federal, other levels of government, public, non-profit, academic, and private sector science to assess risk scenarios involving CBRNE events; to produce solutions that address emerging CBRNE threats or issues; and to deliver S&T capacity and capabilities through products and services.

Findings

Relevance

The CRTI provides a comprehensive, interdepartmental approach to S&T solutions that advance Canada's national capabilities to prepare for, prevent, respond to, and recover from high-consequence CBRNE events. The CRTI has established partnerships within the Public Security S&T community (i.e., with industry, academia, federal and provincial authorities, and local responders) to produce knowledge and capabilities that directly contribute to the Government of Canada's (GoC) role and responsibility of enhancing the safety and security of Canadians.

Overall Assessment

- The CRTI is relevant and supports the public safety and security policies and strategies of the GoC.
- The CRTI facilitates an interdepartmental approach to the development and delivery of science and technology (S&T) solutions to CBRNE threats and issues.
- The governance structure of CRTI, through the CSS, continues to evolve to become more effective.
- Performance monitoring of CRTI projects is effective.
- The CRTI is being managed for results and has delivered national capabilities that enhance the safety and security of Canadians.
- The CRTI is cost-effective.

The CRTI directly supports the Government of Canada's National Security Policy for Canada (2004), the multi-year S&T strategy of the GoC Mobilizing Science and Technology for Canada's Advantage (2007), the *Canada First* Defence Strategy (2008) and the CBRNE Resilience Strategy and Action Plan for Canada (2011).

The CRTI investment priorities are relevant, and have evolved from a sole counter-terrorism focus that was prevalent during the initial funding period (FY 2002/03 to FY 2006/07), to an "all-hazards" approach to public safety and security priorities during this current funding period.

Performance

The joint DND and PS management of the CRTI through the CSS, combined with the broader partnership of other federal departments and agencies, provides a whole-of-government approach to public safety and security policies, plans and operations. The CRTI is being managed for results successfully, but in order to engage participating departments and agencies more effectively and provide valuable strategic direction, the CSS' governance of CRTI and other programs continues to evolve.

During the current funding period, evidence has demonstrated that CRTI projects, investments and exercises have yielded significant results and have enhanced interoperability across science clusters, between levels of government, and between first responders. The threats and risks identified by the consolidated risk assessment process have enabled CRTI investments to develop capabilities and address gaps in all streams of Public Security S&T. For example, the CRTI has sponsored various projects that have advanced technologies to understand the vulnerabilities and risks to Canada's food safety, and to improve animal disease emergency management. Other developments have provided secure web-based capabilities for real-time surveillance, intelligence exchange and response to critical public health events by federal, provincial, and regional health authorities. The CRTI-funded development of CBRNE detection methods and equipment, which have improved the capabilities of responders to rapidly conduct assessments and diagnostics on-site, are now employed across government. CRTI has also made investments to increase the protection of first responders through the development of the first national standard of requirements for protective CBRN equipment.

In 2010, the CRTI's collaborative and outcome-driven approach to S&T was successfully demonstrated with the Major Events Coordinated Security Solutions (MECSS) project. This project addressed the complexity of preparations for potential CBRNE threats to the Vancouver 2010 Olympics and the subsequent G8 and G20 meetings. It brought together S&T resources and expertise from across government and demonstrated maturation from the development of S&T technologies, to the provision of deployed operational capabilities in support of CBRNE counter-terrorism efforts. MECSS exemplified the "operationalizing" of CRTI investments that provided tangible results and directly contributed to the safety and security of Canadians. This capability received international recognition and is being replicated by United Kingdom (UK) authorities for the 2012 Olympics in London.

Efficiency-wise, the ratio of administrative operating costs to CRTI program costs is significantly below the standard 15-percent benchmarking ratio (administrative costs versus total investment budget) for this type of program. In addition, the monitoring of CRTI projects through quarterly progress reports has been established and will contribute to ongoing performance measurement requirements.

Recommendation

The CRTI contributes to the safety and security of Canadians and has improved Canada's CBRNE response capabilities through a whole-of-government approach to the operational delivery of S&T. As the CRTI has demonstrated value for money and is assessed to be relevant and effective, it is recommended that the CRTI continues to be funded.

Note: For a more detailed list of Chief Review Services (CRS) recommendations and management response, please refer to [Annex A](#)—Management Action Plan.



Introduction

This evaluation of the CRTI is conducted in accordance with the GoC's Policy on Evaluation and the Directive on the Evaluation Function.

The CRTI was created as a result of the GoC's 2001 PSAT Budget Plan. As part of the federal government's security agenda, CRTI involves 22 federal departments and agencies that play a role in public safety and security. The role of the CRTI is to enhance Canada's ability to prevent, prepare for, respond to, and recover from CBRNE incidents, including terrorist and criminal activities, accidents and natural disasters through investments in S&T.

A 2006 MOU between DND and PS¹ assigns DRDC² responsibility to manage and operate the CRTI. DND, through DRDC, is accountable for the management and delivery of the CRTI program. CRTI funding for the current five-year funding period (FY 2007/08 to FY 2011/12) was approved at \$35 million per year for a total of \$175 million.

Evaluations were conducted of the CRTI's initial funding period: a formative evaluation was completed in 2006 and a summative evaluation was completed in 2008. In a review of PSAT funding, the CRTI was audited by the Office of the Auditor General in 2005. Financial management audits of CRTI were coordinated through CRS and conducted by PricewaterhouseCoopers LLP for each of the fiscal years ending 31 March 2003 through to 31 March 2006. This is the first evaluation of the CRTI for the current five-year funding period.

Background

Developed and developing nations, economies, societies and cultures are influenced and integrated through globalized communication, transportation, and trade. Emerging and enduring trends include increasing energy demands, disease propagation, environmental degradation, cross-cultural interactions, new political alliances and political instability. National security threats that result from these trends include failed and failing states, proliferation of weapons of mass effect³ and global terrorism. These now shape global insecurity and influence the defence and security priorities of nations. International terrorism and the emergence of radicalized elements within societies of developed nations demonstrate that countries can be vulnerable to such threats. Like other nations, Canada is not immune to a multi-faceted, unpredictable and dynamic terrorist threat environment which includes CBRNE terrorism.

¹ The official name of the department is the Department of Public Safety and Emergency Preparedness. There are five agencies within the Public Safety portfolio: Royal Canadian Mounted Police (RCMP), Canadian Security Intelligence Service (CSIS), Canada Border Services Agency (CBSA), Correctional Service of Canada and the National Parole Board.

² DRDC is a special operating agency of DND.

³ Weapons of mass effect are weapons capable of inflicting grave destructive, psychological and/or economic damage to a nation. These include chemical, biological, nuclear, radiological, or explosive weapons.

The threat of a CBRNE attack against Canada is presently assessed as low; however, the consequences of such an incident could be high. Potential CBRNE weapons can encompass a range of agents: chemical (such as nerve, blister, choking or blood agents, disseminated with explosives or aerosols); biological (such as smallpox, anthrax and plague); and radiological-nuclear (such as a “dirty bomb” which uses conventional explosives to scatter radioactive material). The ability to prepare for, prevent and respond to these types of events requires national-level coordination and collaboration.

The CRTI commenced in 2002 as a five-year initiative to enhance Canada’s ability to prepare for, prevent and respond to chemical, biological, and radiological-nuclear (CBRN) terrorism-related threats to public safety and security. This initial initiative was primarily focused on building interdisciplinary, cross-jurisdictional laboratory clusters⁴ to leverage existing S&T expertise and facilities, and to build relationships between government, industry, academia and first responders.

The original CRTI mandate⁵ was to strengthen Canada’s preparedness for, prevention of, and response to potential CBRNE attacks by fostering new investments in research and technology. At its inception, the CRTI was expected to generate knowledge and technology, and support their application through the following activities:

- creating science clusters of laboratories that build S&T capacity to address the highest-risk terrorist attack scenarios;
- funding research and technology to build capacity in critical areas, particularly those identified with chemical, biological and radiological attacks;
- providing funds to areas where national S&T capacity is deficient because of obsolete equipment, dated facilities, or inadequate scientific teams; and
- developing and sharing CBRNE S&T expertise and knowledge through symposia, exercises, workshops and studies.

The development of laboratory clusters provided the foundation to strengthen the coordination and collaboration of CBRNE capacity, capabilities, research, and technology plans and strategies in Canada. The CRTI was initially comprised of a Chemical Cluster, a Biological Cluster and a Radiological-Nuclear (RN) Cluster. In 2005 a Forensics Cluster was added to provide the forensic aspect to incident response and in 2006, an Explosives Cluster was added. In October 2006 approval was given for CRTI’s original five-year mandate to be extended for an additional five years, through to FY 2011/12.

⁴ Clusters were originally comprised of representatives from federal departments and laboratories. They have now evolved to include agencies, other organizations and responders that have a mandate for public safety and security. Clusters provide members the opportunity to share ideas, knowledge, experience, and resources, and discuss challenges and solutions for addressing potential CBRNE events. The clusters develop capabilities to support their response roles and are an advisory body to enhance Canada's preparedness.

⁵ <http://www.css.drdc-rddc.gc.ca/crti/about-sujet/mandate-mandat-eng.asp>, 21 February 2011 (no longer in use).

With the addition of the Explosives Cluster, the “CRTI” acronym remained the same, but its definition evolved to become the CBRNE Research and Technology Initiative. A Psychosocial Cluster was subsequently added in 2008. Information on CRTI-related Clusters is at [Annex C](#). Through the development of federally led science cluster networks or Communities of Practice⁶ (COP), the CRTI has brought federal, other levels of government, public, non-profit, academic, and private sector science together to assess the risk of various scenarios involving CBRNE events, to produce solutions for emerging CBRNE issues, and to deliver S&T capacity and capabilities through investments in products and services. Capabilities may include plans, procedures, personnel, equipment, infrastructure, and knowledge. A capability gap implies that a task cannot be completed with current resources, whereas a capability deficiency indicates that a capability exists, but is insufficient to meet the target level.

As a result of a 2008 CRTI Summative Evaluation recommendation to further develop CRTI engagement with first responders and a concomitant move towards an all-hazards approach to public safety and security priorities, the phrasing of the CRTI mandate objectives has undergone a subtle shift while maintaining the fundamental tenets of the original mandate. Recognizing the requirements of the first responder and first receiver⁷ communities, and no longer focused solely on terrorist-initiated CBRNE events, the four key CRTI activities have evolved beyond a strict counter-terrorism focus:

- through scientific clusters, building S&T capacity to address the highest all-hazards risks;
- funding S&T to build capability in critical areas, particularly those identified through a capability-based planning approach that looks at all-hazards risks;
- providing funds to those areas where national S&T capacity is deficient owing to obsolete equipment, dated facilities, or insufficient resources; and
- accelerating technology into the hands of the responder communities and other operational authorities.

In the current funding period the CRTI is also operating within a new, yet evolving, governance structure and has augmented its focus to include preparing for, responding to and mitigating the CBRNE consequences of a wide range of hazards including criminal activities, accidents and natural disasters.

⁶ COPs are similar to clusters; however, the capabilities of COPs extend across multiple jurisdictions, including industry and academia, bringing together key federal departments and agencies with provincial, territorial, and private sector partners to define their current challenges and capability deficiencies. This is done in collaboration with members of the S&T community from government, industry, and academia.

⁷ First responders typically act at the site of an incident (e.g., firefighters, law enforcement, hazardous material (HAZMAT) teams and ambulance or paramedic personnel). First receivers are a subset of first responders and typically include personnel in the following roles: clinicians (e.g., physicians, nurses, nurse practitioners, physicians’ assistants, etc.) and other hospital staff who have a role to play in receiving and treating contaminated victims (e.g., triage, decontamination, medical treatment, and security) and those whose roles support these functions (e.g., setup and patient tracking).

Aim

The aim of this evaluation is to assess the continued relevance and performance of the CRTI. This evaluation is a pre-requisite to subsequent program renewal in 2012.

Objectives

In accordance with the Federal Government's Directive on the Evaluation Function, this evaluation will address five core issues:

Relevance

Issue 1: Continued Need for Program. Assessment of the extent to which the program continues to address a demonstrable need and is responsive to the needs of Canadians.

- Question: Is there a need for the CRTI?

Issue 2: Alignment with Government Priorities. Assessment of the linkages between program objectives and (i) federal government priorities and (ii) departmental strategic outcomes.

- Question: Is the CRTI consistent with government policies and priorities?

Issue 3: Alignment with Federal Roles and Responsibilities. Assessment of the role and responsibilities for the federal government in delivering the program.

- Question: Does the CRTI align with current federal roles and responsibilities?

Performance (Effectiveness, Efficiency and Economy)

Issue 4: Achievement of Expected Outcomes. Assessment of progress toward expected outcomes with reference to performance targets and program reach, program design, and including the linkage and contribution of outputs to outcomes.

- Questions: Do the programs and activities funded through the CRTI meet their expected outcomes? To what extent have CRTI activities contributed to increased capability and knowledge among stakeholders?

Issue 5: Demonstration of Efficiency and Economy. Assessment of resource utilization in relation to the production of outputs and progress toward expected outcomes.

- Questions: Are the most appropriate and efficient means being used to achieve the outcomes of the CRTI? Are there more appropriate or effective alternatives for delivering the CRTI programs and activities?

Scope

The evaluation will review and examine the following:

- the role, relevance, organization and performance of the CRTI, including the programs and activities funded through the CRTI since FY 2007/08, by addressing the five core evaluation issues;
- the achievement of expected outcomes; and
- aspects of the CSS, which provides a governance and coordination role for CRTI activities, and its relationship with DRDC, the Assistant Deputy Minister (Science and Technology) (ADM(S&T)) Group in DND, and other organizations as appropriate.

The evaluation does not include any departmental, interdepartmental or international S&T-related activities or projects which do not involve CRTI funding.

The CRTI will be evaluated against the current DND Program Activity Architecture (PAA) (version date: 1 April 2010). The PAA details are as follows, along with the corresponding program activities, components, and their numerical designations. This PAA will also be applicable to the potential renewal of the CRTI in 2012.

Strategic Outcome	Resources are acquired to meet Government Defence Expectations (1.0)
Program Activity	Defence Science and Technology (1.1)
Program Sub-Activity	Research Technology and Analysis (1.1.1.0) Public Security Science and Technology (1.1.2.0)

Methodology

The research methodology incorporates multiple lines of evidence to ensure the reliability of information collected and results reported. Fieldwork for this report was conducted from November 2010 to June 2011. The evaluation matrix is presented at [Annex I](#) and outlines the lines of evidence used to support the findings in relation to the evaluation issues and questions.

The initial document review provided an understanding of the CRTI and its context to assist in the planning of the evaluation. A comprehensive document review was then conducted to collect information on CRTI activities and projects and to assess program data, such as financial and performance measurement information. A review of other documentation focused on contextualizing the CRTI departmentally, nationally and internationally. The evaluation identified how the CRTI has evolved during the previous and current funding periods, and examined departmental and national requirements and whether CRTI activities complement or duplicate other S&T activities. Synopses of specific CRTI-funded projects, activities, exercises and workshops are presented (n=23) to illustrate their impact.

Interviews with key informants (n=20) served as an important source of information. These provided context to the documentation review and data analysis as well as qualitative input on the evaluation questions. Some informants were interviewed multiple times.

The evaluation team attended the CSS Summer Symposium (June 2011) which targeted stakeholders from municipal and provincial governments, federal departments and agencies, industry and academia. The evaluation team received presentations on CRTI projects and engaged CRTI stakeholders in informal discussions. A CSS-initiated program feedback questionnaire was provided to all attendees of the symposium. The CSS questionnaire was developed to determine stakeholders' assessment of the impact of CSS programs, contribution to outcomes, and the level of satisfaction with CSS-related activities. Of 340 registrants to the Symposium, there was a 25-percent response rate (n=85). Of the 85 respondents, 74 percent (n=63) have been involved with the CRTI.

Limitation of Study

Given the CRTI's wide range of activities, this evaluation was limited to reviewing core CSS and CRTI documentation and conducting focused interviews with select personnel involved with the CSS and CRTI projects and activities, including the applicable science clusters, for a representative sample to enable a balanced and informed evaluation. Interviews were conducted with key informants from DND, DRDC, RCMP and PS.

The CSS manages the Public Security Technical Program (PSTP) which includes the CRTI, the Canadian Police Research Centre (CPRC) and the identically named Public Security Technical Program (Pstp), albeit with a similar, but lowercase acronym. The CPRC and the Pstp are not within the scope of this evaluation and are only addressed when needing to place the CRTI in context with the CSS. At present, all are mandated to implement their respective activities as directed by specific federal government budget plans and in accordance with Treasury Board Secretariat (TBS) direction.

The CSS questionnaire targeted stakeholders involved with CSS activities; however it was limited to responses from stakeholders attending the Summer Symposium. In addition, this questionnaire gathered broad information about CSS programs, not specifically about the CRTI activities. For relevance to this evaluation, the reported responses were collated from CSS respondents who have been involved with the CRTI programs and activities.

While the immediate and intermediate outcomes of CRTI projects and activities are usually evident, associating long-term outcomes with specific CRTI projects or activities is more challenging as S&T knowledge is cumulative and consequential impacts can occur long after activities have taken place.⁸

⁸ A review of empirical research on research and development (R&D) lag times conducted by the GoC Policy Research Initiative in "Improving the Measurement, Reporting and Assessment of Federally Performing S&T – Demonstrating Results for Canadians – Final Report" (page 22) indicates that when assessing the impacts of S&T, a time period of 10 years or more may be appropriate between activities and final outcomes.

This evaluation was not scheduled in the DND/Canadian Forces (CF) Evaluation Plan FY 2010/11; hence, it was a non-forecasted activity. As this evaluation is a pre-condition for CRTI renewal in 2012, it was necessary to complete it before the end of 2011.

Description of Program

During the initial funding period, the coordination of CRTI activities was conducted by a CRTI Secretariat within DRDC. The 2006 program renewal document for the current funding period stipulated that the CRTI governance and the Pstp governance would be harmonized. To fulfill this objective, the CRTI Secretariat ceased to exist in the current funding period, and its functions were merged within the CSS structure.

The CSS is designated as one of nine research centers within DRDC; however, it is unique from the other research centers as a result of its management construct and mandate. The CSS is designed—through the 2006 MOU between DND and PS—as a joint endeavour between these two departments to provide S&T services and support to address national public safety and security objectives with 20 other federal departments and agencies.⁹ While DND is in partnership with PS, only DND has authority over the funding of S&T initiatives related to public safety and security.¹⁰

The CSS is responsible for the management of specific federal S&T programs related to public safety and security and it is also the entity through which DRDC provides S&T expertise and services to PS. In general terms, the role of CSS is to coordinate research; develop, test, and evaluate technologies; identify future trends and threats; and develop networks with national and international S&T partners within the public safety and security communities.¹¹ Under the direction of the Director S&T for Public Security (DSTPS) and the CSS Corporate Services Manager, the CSS now develops, recommends and manages CRTI administrative and program policies and procedures, coordinates the project selection process, and manages CRTI program funding through the Portfolio Managers.

The CRTI investments fund collaborative S&T research activities, referred to as CRTI projects. There are two broad categories of CRTI investments:

- **Competitive.** Program investments made in response to broad priorities or specific requirements which are open to the public and private sector through a competitive or open “Call for Proposals” process.
- **Targeted.** Program investments made to fill gaps not being met through a competitive process. These are solicited through normal Public Works and Government Services Canada (PWGSC) procurement and contracting processes.

⁹ A listing of departments and agencies participating in the CRTI Science Clusters is at [Annex C](#).

¹⁰ CSS Business Line 3 Program Partner Group FY 2010-2013, page 95. For additional details, refer to the evaluation section: CRTI Financial Management.

¹¹ CRTI Call for Proposals Bidder Guidebook for Call 9 (2010), page 5.

The CRTI-related science clusters are generally represented within the “CBRNE Defeat” Partner Group.¹² The Section Head of the “CBRNE Defeat” Partner Group is now responsible to fulfill the mandate of the CRTI and reports to the DSTPS (see Figure 1). The CRTI Portfolio Managers, responsible for the Chemistry, Biology, RN, Explosives, Forensics and Psychosocial portfolios report to the Section Head of the “CBRNE Defeat” Partner Group.

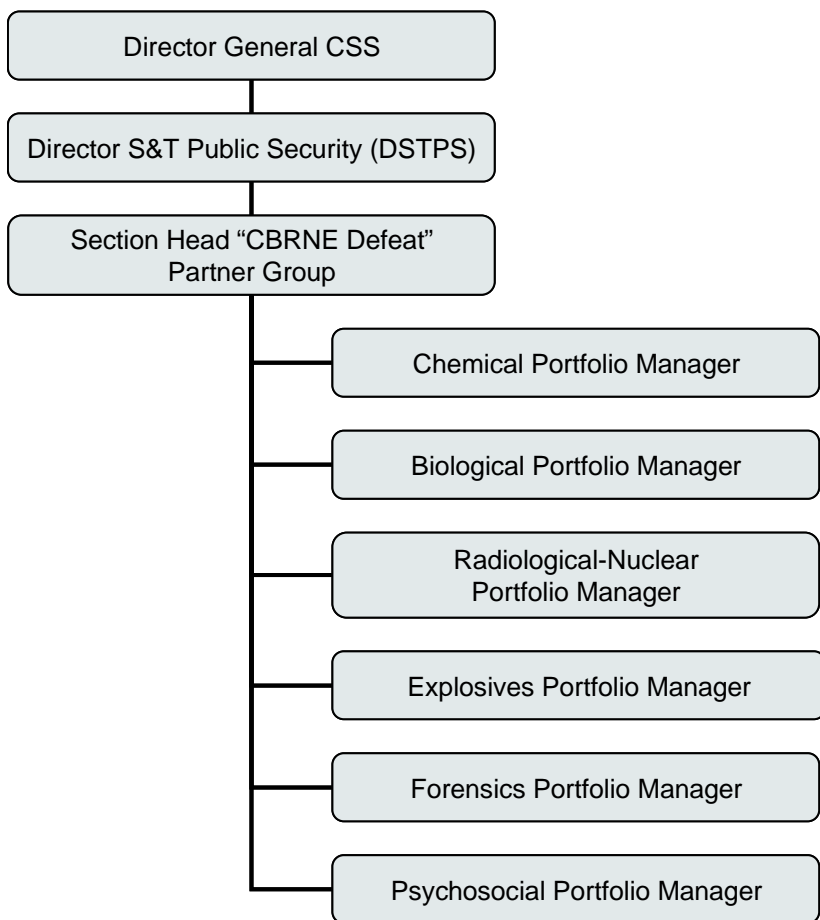


Figure 1. Organization of CRTI Components within the CSS. This organization chart shows the organization and relationship between the CRTI Portfolio Managers and the DSTPS.

CRTI Investment Priorities

The CSS identifies the CRTI funding priorities through a consolidated risk assessment process and a capability-based investment model. Within these processes the CSS draws on the expertise of the intelligence community, other federal partners, and the science clusters which conduct threat assessments, risk assessments and capability analysis for full-spectrum scenarios. Options are then determined to reduce the assessed risks to the safety and security of Canadians and how to address the identified gaps and vulnerabilities.

¹² The “CBRNE Defeat” Partner Group has also been referred to as “CBRN Countermeasures” Partner Group in some CSS documentation.

The risk assessment process involves a systematic evaluation of plausible CBRNE scenarios which focus on technical feasibility, likelihood and impact. It is comprehensive and engages experts from federal S&T, operational, law enforcement and intelligence communities. The CSS uses this process to assist decision-makers in understanding the risks posed by CBRNE events. The process is conducted biennially, with the following objectives:

- providing a measure of risks and corresponding capability gaps;
- providing common understanding for addressing threats and corresponding gaps; and
- serving as a key indicator in the formulation of S&T investment priorities.

On completion of the consolidated risk assessment, high-risk scenarios are developed through the Investment Model process (see Figure 2). A capability assessment is conducted for each high-risk scenario in order to reveal capability gaps or deficiencies by measuring the difference between current capabilities and target capabilities. This process forms the basis for the CRTI S&T investment priority recommendations. Other factors that may influence investment priorities include emerging security and safety strategies, policies and guidance; the evolving global security and safety environment; international agreements and programs; whole-of-government S&T priorities; and ongoing CF operations.

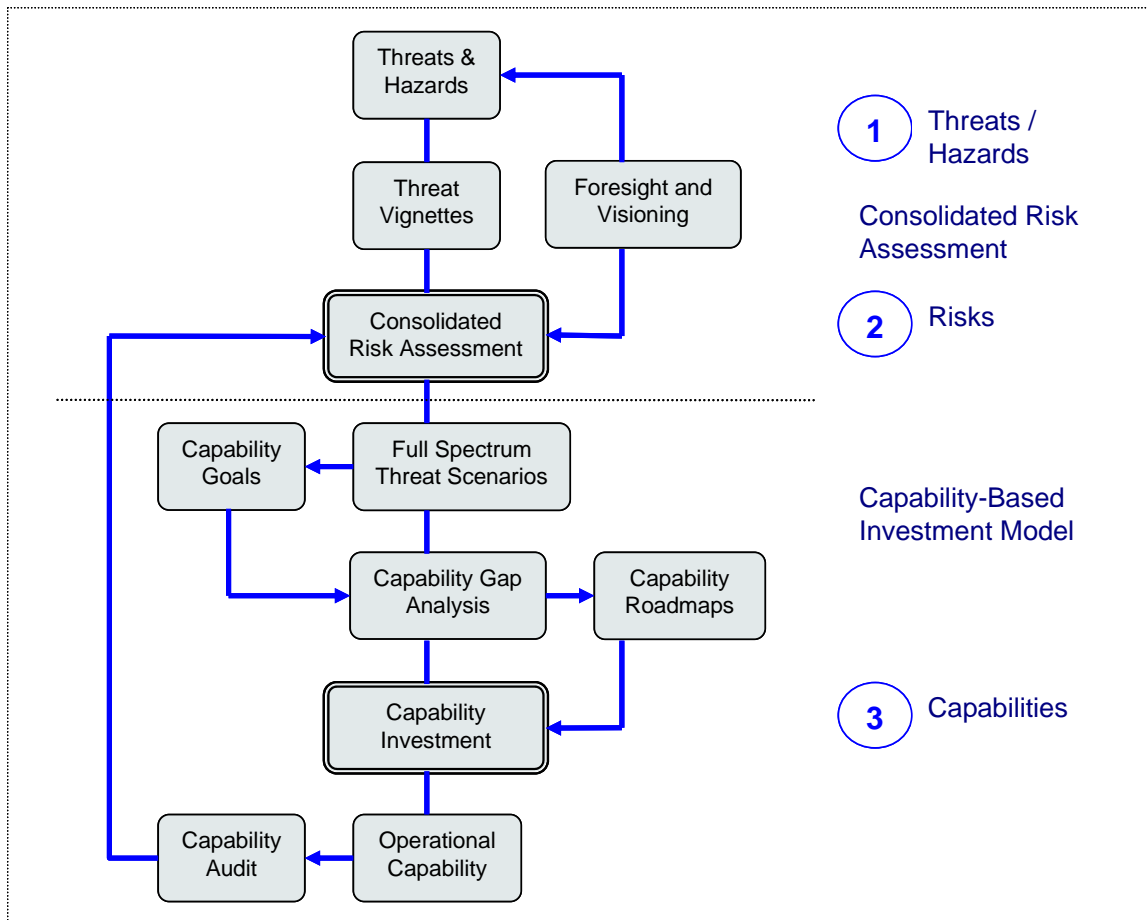


Figure 2. Capability-Based Investment Model. This flowchart shows the relationship between the consolidated risk assessment and the capability-based investment model.

The priorities are published in the CRTI Call for Proposals Bidder Guidebook, which outlines the priorities for new CRTI projects. Through this process, the CSS solicits and assesses proposals from government, industry and academia to fund research activities which address capability gaps from the investment priority areas and which demonstrate relevance to CBRNE event prevention, preparedness, response and recovery. Funding is competitive and covers activities that can vary from emerging S&T research through to the acceleration of mature technologies across numerous science domains. During the current funding period, the four public CRTI Calls for Proposals have each focused on identified investment priorities and are listed at Table 1. The table shows a shift in investment priorities from the initial funding period, which influenced Call 6, through to the latest Call for Proposals, Call 9.

CRTI Investment Priorities (Call for Proposals #6 to #9)	CRTI Call for Proposals			
	#6	#7	#8	#9
C4I for CBRN Planning and Response	A	N/A	N/A	N/A
Equipping and Training First Responders	A	N/A	N/A	N/A
Immediate Reaction and Near-Term Consequence Management Capabilities	A	N/A	N/A	N/A
Longer-term Consequence Management Issues	A	N/A	N/A	N/A
Prevention, Surveillance and Alert Capabilities	A	N/A	N/A	N/A
System-of-Systems Approach to Capability Management	N/A	A	N/A	N/A
Risk Assessment and Priority Setting	A	A	A	A
Explosives – Threat and Capabilities	N/A	A	A	A
Medical and Casualty Management	N/A	A	A	A
Public Confidence in Psycho-Social Behavioural Factors	A	A	A	A
Criminal and National Security Investigation Capabilities	A	A	A	A
Safety of the Food System	N/A	A	A	A
Emerging innovative CBRNE S&T	N/A	A	A	A
CBRNE Detection (and Identification)	N/A	N/A	A	A
Exploitation and Sustainment of Investments, including Capability-Based Planning Validation	N/A	N/A	A	A

Legend:

A – Applicable
 N/A – Not Applicable

Table 1. CRTI Call for Proposals Investment Priorities. This table identifies the CRTI investment priorities for CRTI Calls for Proposals 6 through 9.

During the initial CRTI funding period, emphasis was placed on post-incident scenarios such as Immediate Reaction, Near-Term Consequence Management and Longer-Term Consequence Management. The scenario spectrum (Figure 3), presently employed by CRTI, considers a high-consequence event over the entire event continuum and focuses on both pre-event and post-event actions.

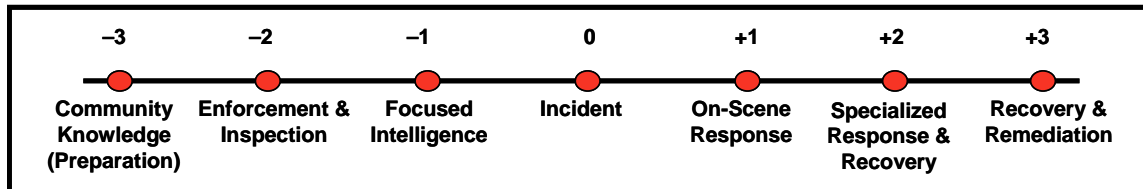


Figure 3. Scenario Spectrum. This figure outlines the pre-event and post-event actions surrounding an incident. On this event horizon, seven phases of a terrorist event range from -3 to +3 in time.

While counter-terrorism was the sole focus of the initial funding period, the CRTI investment priorities now focus on an all-hazards approach and seek a balance between the highest risks and threats to the Canadian public. Current investment priority areas such as “Safety of the Food System” do not focus on a specific phase along the scenario spectrum. Instead, recent investment priorities seek solutions that address all-hazards threats identified through the consolidated risk assessment and capability-based planning processes. This is intended to provide greater capabilities to prevent, prepare, respond and recover from high-consequence events. Using the full spectrum approach of capability-based planning, there has also been an increase in projects focussed on pre-incident phases.



Findings and Recommendations

Relevance

Issue 1: Continued Need for the Program. Assessment of the extent to which the program continues to address a demonstrable need and is responsive to the needs of Canadians.

As the potential consequences of a CBRNE incident are sufficiently severe, the GoC has taken a comprehensive approach to improve the nation's preparedness to protect Canadians from CBRNE events.¹³ Effective response to CBRNE events, whether the direct result of terrorist or criminal acts, industrial accidents or indirectly caused through natural disasters such as earthquakes or tsunamis, require cooperation and coordination between all levels of government, response organizations and international partners. As such, the CRTI was developed as part of the federal government's public safety and security agenda. It was designed to provide S&T solutions that advance Canada's national capabilities to prepare for, prevent, respond to, and recover from high-consequence public safety and security events.

As a CSS-managed program, the CRTI has also become a focal point to address the need for a coordinated national approach to the sharing of Public Security S&T knowledge with allies. To contribute Canadian CBRNE expertise from the CRTI and leverage international S&T expertise for the safety and security of Canadians, the CSS is signatory to numerous international MOUs.¹⁴ The CSS is also a participant in other relevant international fora¹⁵ on terrorism and CBRNE issues which involve work coordinated by the CRTI on behalf of the GoC. DRDC and the UK Centre for the Protection of National Infrastructure have also signed an MOU on Public Security and Safety Cooperative Science and Technology which facilitates, among other things, the sharing of lessons learned by the CSS at the Vancouver 2010 Olympic Games with the organizers of the London 2012 Olympic Games.

The CRTI leverages S&T to close gaps and improve Canada's CBRNE response capabilities by providing new technology and techniques to support Canada's first responder communities. As part of a federal response network, the science clusters created by the CRTI continue to underpin an interdepartmental approach to CBRNE S&T activities. To counter an unpredictable and evolving CBRNE terrorism threat to Canada and the potential for a CBRNE event from an accident or natural disaster, the CRTI provides Canada with an operational S&T focus, direction and results through pan-departmental and international S&T coordination.

¹³ Securing an Open Society: Canada's National Security Policy (April 2004) and the CBRNE Resilience Strategy and Action Plan for Canada (2011).

¹⁴ MOU signatories with the CSS include the US Department of Homeland Security (DHS); the US Department of Defense (DoD); and the UK Centre for the Protection of National Infrastructure.

¹⁵ CSS membership includes the Quadrilateral Group on Chemical, Biological, Radiological Counter-Terrorism; the Global Initiative to Counter Nuclear Terrorism; the Global Health Initiative; the Science, Technology and Trade Advisory Group; and the US-Canada Bilateral Consultative Group on Counter-Terrorism.

Finding

- The CRTI contributes to the safety and security of Canadians. The CRTI meets a continuing need to improve Canada's CBRNE response capabilities through a shared, whole-of-government approach to the operational delivery of S&T.

Issue 2: Alignment with Government Priorities. Assessment of the linkages between program objectives and (i) federal government priorities and (ii) departmental strategic outcomes.

National security is a duty of the GoC. The mandates of PS, DND and other federal departments require that Canada be prepared for, and be able to respond to current and emerging threats. While government priorities can shift, a review of Speeches from the Throne from the past decade reveals common themes which include the priority of “keeping Canadians safe.” The 2010 Speech from the Throne stated: “Canada faces real, significant and shifting threats. Our Government will take steps to safeguard Canada’s national security.”¹⁶ The 2011 Speech from the Throne stated: “The Government of Canada has no more fundamental duty than to protect the personal safety of our citizens and defend against threats to our national security.”¹⁷

In 2004, the federal government issued Canada’s National Security Policy¹⁸ which adopts an integrated approach to security issues across government. The policy, titled “Securing an Open Society,” articulates core national security interests and proposes a framework for addressing threats to Canadians. To strengthen the government’s performance and capacity to manage complex emergencies, the policy outlined “increased resources for dealing with CBRN attacks including networked federal laboratories for research...and the accelerated delivery of new technologies to first line responders through the CRTI.”¹⁹

The following year, in 2005, the GoC released the “Chemical, Biological, Radiological and Nuclear (CBRN) Strategy of the Government of Canada.” This strategy supported Canada’s National Security Policy and the 2001 Public Security and Anti-Terrorism initiative. In January 2011, the strategy was superseded by the CBRNE Resilience Strategy and Action Plan for Canada. The Strategy and Action Plan are part of Canada’s National Emergency Management System and provide a policy framework to guide the creation and maintenance of capabilities, standards and investments in a common direction across the four components of emergency management:²⁰

- prevention and mitigation,
- preparedness,
- response, and
- recovery.

¹⁶ 2010 Speech from the Throne, 3 May 2010, page 14.

¹⁷ 2011 Speech from the Throne, 3 June 2011, page 12.

¹⁸ Securing an Open Society: Canada’s National Security Policy (April 2004).

¹⁹ Ibid., page 22.

²⁰ CBRNE Resilience Strategy for Canada (2011), page 3.



The Strategy states that “The threat of CBRNE events is a global challenge. Terrorist attacks are increasingly focussed on western interests and Canada has been specifically identified as a target by terrorist organizations. Canada is also at risk from domestic sources such as radicalized individuals, extremists and criminals.”²¹ To respond to the CBRNE threat, the CBRN Resilience Action Plan for Canada is based on five key strategic objectives that are identified as being core to developing CBRNE resilience:²²

- provide leadership for coordinated policy and program development;
- integrate CBRNE into an all-hazards risk management approach;
- use capability-based planning to inform policy, program and investment decisions;
- build and effective and interoperable workforce; and
- optimize information and knowledge management.

Through the *Canada First Defence Strategy* (2008), the Government established capability levels and assigned tasks for the CF to meet the country’s defence needs, enhance the safety and security of Canadians, and support the Government’s foreign policy and national security objectives.²³ The Strategy notes that challenges to domestic security include possible terrorist attacks, among other threats; and should the need arise the CF will support their emergency management partners across Canada.²⁴ In addition, the Strategy adds, “through DRDC, DND has a long history of working with Canadian industry and with its allies, and will collaborate with defence partners to derive maximum benefit from technology and the development of technology.”²⁵

Other GoC strategies that support the CRTI mandate and objectives include:

- **Advantage Canada** (2006), which states that “Government will invest and seek partnerships with the provinces and the private sector in strategic areas that contribute to strong economies—including primary scientific research ...”²⁶
- **An Emergency Management Framework for Canada** (Second Edition) (January 2011), which notes that emergency management in Canada has traditionally focused on preparedness and response and states that “Addressing the modern hazardscape requires [federal, provincial and territorial] governments to deal with specific risks, hazards and vulnerabilities through prevention and mitigation measures as well as recovery measures.”²⁷

²¹ Ibid., page 1.

²² CBRNE Resilience Action Plan for Canada, page 1.

²³ Canada First Defence Strategy, page 3.

²⁴ Ibid., page 6.

²⁵ Ibid., page 20.

²⁶ Advantage Canada (2006), page 22.

²⁷ An Emergency Management Framework for Canada (2011), page 5.

In the DND PAA, the CRTI falls under the Program Activity “Defence Science and Technology” within the Sub-Activity “Public Security Science and Technology”, which is part of the Departmental Strategic Outcome for “Resources are acquired to meet Government Defence Expectations.” This program sub-activity comprises S&T activities of research, development, analysis and experimentation to inform, enable and respond to public safety and security priorities.

The Defence Priorities (2011-2014)²⁸ link ADM(S&T) to this PAA sub-activity through the ongoing Management Priority of Maintaining Defence Affordability (*Canada First Defence Strategy* – Strengthening key military capabilities through management of investment in each of the pillars) through the requirement to “Contribute to *Advantage Canada*.” The Program Activity “Defence Science and Technology” also links to the GoC Outcome Areas of “an innovative and knowledge-based economy” and “a safe and secure Canada.”²⁹

The 2009-2010 Departmental Performance Report (DPR) noted that “within the scope of research and development support to the public safety and security community, Defence made several high impact contributions over the review period.” This included support “with the mobilization of a wide range of science and technology expertise in the area of CBRNE, among other areas...” to the GoC priorities of a successful 2010 Vancouver Olympic/Paralympic Games (Op PODIUM) and the 2010 G8 and G20 Summits (Op CADENCE). The DPR noted that DND deployed a suite of CBRNE mobile laboratories along with scientific and technological expertise from several key departments and agencies including the Public Health Agency of Canada (PHAC), Environment Canada (EC), Health Canada (HC), and Natural Resources Canada (NRCan), and that “this level of support was made possible through previous investments by the Defence-led CRTI, made jointly with public security partners.”

The 2010-2011 DND Report on Plans and Priorities (RPP) also recognizes the CF as a major security partner for the G8 and G20 Summits, providing unique military capabilities including support to CBRN incidents and other technical expertise.³⁰ The 2011-2012 DND RPP noted that the MECSS Project, which supported the 2010 Winter Games and the G8 and G20 Summits, is now leading to the development of a major events planning framework to be used by the RCMP, and eventually all of Government.³¹

Finding

- The CRTI aligns with federal government strategies, priorities and departmental strategic objectives.

²⁸ Chief of the Defence Staff / Deputy Minister Letter. 1901-1 (DDFP 4) 26 November 2010.

²⁹ <http://www.vcds.forces.gc.ca/sites/page-eng.asp?page=8409> and <http://www.tbs-sct.gc.ca/ppg-cpr/descript-eng.aspx>, 11 February 2011.

³⁰ DND RPP, pages 35-36 <http://www.tbs-sct.gc.ca/rpp/2010-2011/inst/dnd/dnd-eng.pdf> (no longer in use).

³¹ DND RPP, page 31 <http://www.tbs-sct.gc.ca/rpp/2011-2012/inst/dnd/dnd-eng.pdf> (no longer in use).

Issue 3: Alignment with Federal Roles and Responsibilities. Assessment of the role and responsibilities for the federal government in delivering the program.

In 2007 the GoC set out a comprehensive multi-year S&T strategy, “Mobilizing Science and Technology to Canada’s Advantage,” to support S&T collaboration involving the business, academic, and public sectors, at home and abroad. This strategy provides a framework to guide government policy and program decision making, and contributes to the implementation of specific measures that build upon *Advantage Canada*, to “invest and seek partnerships with the provinces and private sector in strategic areas...” Through this S&T strategy, the GoC seeks to enhance Canada’s S&T capability and improve the lives of Canadians.

The *Canada First* Defence Strategy notes that “defending Canadians from threats to their safety and well-being is a critical role for government”³² and articulates the federal role of ensuring the security of Canadians. In addition, Canada’s National Security Policy focuses on events that require a GoC response and which are generally beyond the role or capacity of individuals, communities or provinces to address alone.

The CRTI presently operates within the GoC’s PSAT initiative to enhance the safety and security of Canadians and is an example of S&T collaboration at a national level. As a program within the CSS, the CRTI partners with the Public Security S&T community—industry, academia, federal and provincial authorities as well as local responders—to produce knowledge and capability that directly contribute to the GoC’s role and responsibility of enhancing the safety and security of Canadians.

Finding

- The CRTI aligns with, and directly supports, the roles and responsibilities of the federal government.

Performance (Effectiveness, Efficiency and Economy)

Issue 4: Achievement of Expected Outcomes. Assessment of progress toward expected outcomes with reference to performance targets and program reach, program design, including the linkage and contribution of outputs to outcomes.

With creation of the CSS during the current funding period and harmonization of the CRTI governance with other CSS-led programs, the CSS developed a Public Security S&T Logic Model (2010) ([Annex B](#)) which encompasses the Public Security S&T Program components of CRTI, Pstp and CPRC. This current logic model reflects the maturation of Public Security S&T and CRTI’s all-hazards approach to investment prioritization. A logic model specific to the CRTI was not developed by the CSS for the current funding period. Instead, the Public Security S&T Logic Model was developed to satisfy both DND and PS requirements and provides the framework by which all GoC investments in Public Security S&T are made.

³² *Canada First* Defence Strategy, page 5.

Public Security S&T outcomes are enabled through CRTI investments in activities and in projects selected through the CRTI Calls for Proposals and other processes. Projects selected for funding via the CRTI Call for Proposals process are categorized using a Technology Readiness Level (TRL) framework ([Annex D](#)). CRTI uses the TRL to describe the R&D continuum from basic research through to engineering, development and the eventual commercialization of a product. Using this framework, the CRTI defines project categories as Research and Technology Development (RD) projects (at the earlier stages of applied science); Technology Demonstration (TD) projects (where applied science is being transferred into the operational setting to demonstrate utility for the responder community); or Technology Acceleration (TA) projects (which shift the products to the responder community and prepare S&T projects for commercialization). A fourth project category is Technology Acquisition (AP). AP projects are selected for funding through a separate “Cluster Support and Technical Acquisition” process and are managed within the science clusters to address the highest priority capability gaps. Although they are not publicly competed through the CRTI Calls for Proposals, AP projects do go through a competitive contracting process via PWGSC. For a detailed definition of the project categories, please refer to [Annex E](#).

In the absence of program performance measurement criteria for the CRTI, this evaluation will assess CRTI effectiveness and progress toward expected outcomes through the examination of each key CRTI activity previously identified:

- through science clusters, building S&T capacity to address the highest all-hazards risks;
- funding S&T to build capability in critical areas, particularly those identified through a capability-based approach that looks at all-hazards risks;
- funding those areas where national S&T capacity is deficient owing to obsolete equipment, dated facilities, or insufficient resources; and
- accelerating technology into the hands of the responder communities and other operational authorities.

Each key CRTI activity will be linked to one or more of the three streams of program activity outlined in the Public Security S&T Logic Model:

- **Logic Model Stream 1.** Enabling Public Security Capabilities (in order to prevent, prepare, respond and recover to incidents);
- **Logic Model Stream 2.** Interoperable Prevent-Response-Recover systems (which provide for a trans-jurisdiction and national integrated systems and approach); and
- **Logic Model Stream 3.** Public-private Preparedness and Confidence (to support an alert and resilient society).

These three streams of program activity address the development of capabilities to contribute to the safety and security of Canadians. They also serve to enhance the ability of responders to coordinate effective prevention, preparedness, response and recovery, in addition to the ability of the public to prepare and recover from high-consequence events, whether they be malicious, accidental or naturally occurring. The following sections also

provide representative synopses of CRTI projects and activities as evidence of how the mandate of CRTI is being met, and explain how CRTI is contributing to public safety and security outcomes.

CRTI Activity (1):

“Through science clusters, build and address S&T capacity to address the highest all-hazards risks.”

To harness and better utilize existing CBRNE R&D capabilities in Canada, the CRTI-initiated science clusters (n=6) have brought together federal and other laboratories previously conducting work independently to focus on emerging Public Security S&T issues and to leverage capabilities. The participating departments, agencies and other organizations in CRTI clusters range from n=12 to n=23. This has enhanced the clusters’ ability to identify and address capacity and capability gaps. In addition, the new Forensics, Explosives and Psychosocial S&T clusters have enhanced CRTI’s ability to more comprehensively address risks and capability gaps and facilitate interoperability between cluster members working in each specific area. In the CSS questionnaire, 40 percent of CRTI stakeholders identified that the major successes of CRTI are “increased horizontal linkages” and “enhanced scientific capacity”; these are a result of the CRTI cluster construct.

Two sample projects contributing to achieving immediate and intermediate outcomes in **Stream 1 “Enabling Public Security Capabilities” of the Public Security S&T Logic Model**, and which have addressed capability gaps and contributed to the development of risk methodologies include CRTI 089-0234TD (Modeling the Effects of Public/Animal Health Emergencies on Laboratories); and CRTI 07-0109RD (Development and Application of Foresight and Future Visioning to Support Capability-Based Planning for Animal Disease Emergency Management). Synopses of these two projects are provided in Examples 1 and 2:

Example 1

Modeling the Effects of Public/Animal Health Emergencies on Laboratories (CRTI 08-0234TD)
<p>Led by PHAC, this project resulted in the development of S&T tools for exploitation by laboratories to identify resource gaps and process vulnerabilities in the testing influx expected during a public/animal health biological threat.</p> <p>Public/animal health laboratories are part of the primary response to a biological threat. This project developed modeling capabilities to assess laboratory surge needs during a bio-threat emergency. The resulting tools highlight gaps in the surge response capabilities of these laboratories, based on specific biological agents. This allows participating laboratories to assess risks and address surge capacity, thus decreasing the impact of a bio-threat.</p> <p>This tool is helping PHAC and the Canadian Food Inspection Agency (CFIA) identify risks and capability gaps associated with their capacity to deal with a surge of activity during a public/animal health emergency. It has also been trialed in 20 US State Public Health Laboratories.</p>

Example 2

Development and Application of Foresight and Future Visioning to Support Capability-Based Planning for Animal Disease Emergency Management (CRTI 07-0109RD)

This CFIA-led project provides tools to anticipate, prevent, prepare for and respond to animal health emergencies.

“Foresight” is defined as a set of strategic tools that emphasize a long-term perspective to gain insight on future needs and priorities. It can help chart likely futures and inform key decision making on investments in capability.

Through participation from federal, provincial, academic, and industry partners, this project is an effective part of capability-based planning and contributes to a better understanding of vulnerabilities and risks to Canada’s food safety. This project is also contributing to a better understanding of best practices, methodologies and tools related to risk and vulnerability analysis.

Anticipated project completion: 2011.

Other CRTI projects supporting **Stream 1 “Enabling Public Security Capabilities” of the Public Security S&T Logic Model** are having significant impact as they became operational, and will enable capabilities in the long term. While it is too soon to definitively demonstrate long-term outcomes associated with some projects, in their current levels of readiness and ongoing deployment, CRTI 06-0255TA (Medical and Casualty Management Command Post and Temporary Treatment Center (Med Post)) and CRTI 06-0204RD (Improvised Explosive Assessment Tool) are poised to have significant impact and positive long-term outcomes for high-consequence events. They are outlined in Examples 3 and 4:

Example 3

Medical and Casualty Management Command Post and Temporary Treatment Center (Med Post) (CRTI 06-0255TA)

In response to deficiencies identified during the 2003 Severe Acute Respiratory Syndrome (SARS) crisis, this deployable system delivers data needed by healthcare crisis management authorities to reduce morbidity and mortality associated with CBRNE events by integrating responder information systems. In March 2011, Med Post received additional funding from the PWGSC Canadian Innovation Commercialization Program to make the system commercially available within Canada and internationally, demonstrating its value potential as a response to high-consequence CBRNE events. In the event of a high-impact healthcare crisis, this project is well positioned to fill an identified high-risk area and capability gap.

Med Post is currently deployed in Grey-Bruce County in Ontario and in New Brunswick, filling a capability gap identified through past public health crises.

Through commercialization it will contribute to a longer-term capability to prepare for and respond to high-consequence events.

Example 4

Improvised Explosive Assessment Tool (CRTI 06-0204RD)

This project delivers a database to help investigators and first responders obtain quick, evidence-based assessments of many improvised explosive formulations, composition and recipes. This project has leveraged contributions from partners within Canada: Transport Canada (TC), NRCan—Canadian Explosives Research Laboratory, CSIS and RCMP—Canadian Bomb Data Centre and from allies in the US, UK and Australia. This has expanded the available body of knowledge of homemade explosives, both nationally and internationally.

Results to date have positively impacted the security of Canada, e.g., support to law enforcement/prosecution efforts for RCMP “Project OSAGE” (Toronto 18); the Regina versus Arnaout (Pipe Bombs), and G8/G20 security. Federal, provincial and municipal police organizations have also used the tool to inform the collection and presentation of forensic evidence and inform canine detection methods. The tool has also led to the publication of the “Canadian Homemade Explosives Precursor Booklet” which aids first responders in identifying precursors and homemade explosive threats. This project has also led to training for the CF, and to civilian and military bomb squads through the Counter Terrorism Technology Centre at Canadian Forces Base Suffield, Alberta.

This project has helped consolidate a vast body of knowledge now contributing to prevention and preparedness efforts against Improvised Explosive Devices, while aiding in responding to these threats and the subsequent prosecution of suspects.

CRTI AP investments have also significantly enhanced public safety and security capabilities and include the eight mobile CBRNE laboratories that deployed to Vancouver and Whistler, British Columbia (BC) for the 2010 Olympic and Paralympic Games, and their subsequent deployment in June 2010 to the G8 Summit in Huntsville, Ontario, and to the G20 Summit in Toronto, Ontario. When on-site, these mobile CBRNE laboratories eliminate the need to transport samples, and save time critical for incident management activities such as medical countermeasures, site decontamination, public health investigations, and quarantine implementation. The mobile CBRNE laboratory initiative is a pan-cluster activity and an example of the collaborative efforts and outcomes achieved through the CRTI as a pan-departmental program. The initiative represents the full range of science cluster activities, investments and knowledge generated since the CRTI’s inception. The laboratories are to be maintained by designated departments and are designed as deployable assets to enhance the public safety and security capabilities of the GoC.

CRTI projects and activities have contributed to achieving immediate and intermediate outcomes in **Stream 2 “Interoperable Prevent-Response-Recover Systems” of the Public Security S&T Logic Model**. Cluster outputs, including AP investments, workshops, exercises and training, have created outcomes that enhance the operational capability and S&T capacity of cluster members to address all-hazards risks via the transfer of knowledge and expertise. CSS initiatives, including the Annual Summer Symposium and other knowledge management activities, have increased the awareness and knowledge of CRTI investments to participants in government, industry and academia. In the CSS questionnaire, CRTI stakeholders assessed how DRDC CSS

programs have contributed to Public Security S&T knowledge and provided an above-average rating between “Significant Contribution” and “Very Significant Contribution,” scoring 4.1 out of 5.0.

Through this enhanced knowledge base, cluster members’ improved situational awareness of risks and threats allows for enhanced communication and understanding between individual members and organizations. Two examples of CRTI AP investments which support Stream 2 include the Coroners’ Workshop: Handling of Contaminated CBRN Fatalities (January 2009) and RN 048 AP / RN 081AP (Special Event Roving Spectrometer Network). An overview of these projects/activities and their impact are provided in Examples 5 and 6:

Example 5

Coroners’ Workshop: Handling of Contaminated CBRN Fatalities

This CRTI-sponsored workshop in January 2009 brought together experts from Canada, the US, the UK, Belgium, and Brazil to Vancouver to share first-hand experience in handling CBRN contaminated fatalities.

The objective was to increase awareness about CBRN events resulting in contaminated fatalities, and to provide a forum for subject matter experts to outline guidelines or protocols for CBRN fatality events and establish general training requirements for secondary responders.

This workshop was planned as a result of lessons learned from Biological Incident Exercise West (Bi-Ex West) which revealed that Canada did not have national procedures, protocols, or standards for handling fatalities contaminated by CBRN agents. It also revealed that although resources and training were increasingly made available to first responders to respond to CBRN incidents, secondary responders such as coroners, medical examiners and pathologists remained largely unprepared to respond to these types of incidents. Participants indicated that they are now better informed about existing resources and have broadened their networks of experts and resource persons who can support them within their own regions.

Example 6

Special Event Roving Spectrometer Network (RN 048 AP and RN 081AP)

Identified via the CRTI consolidated risk assessment, the acquisition and deployment of this equipment addresses the need to detect radioactive sources and dispersal devices at major public venues. With a number of high-profile public events hosted in Canada during the evaluation period, this capability became crucial.

Led by HC and implemented by integration with security staff and existing monitoring systems, this project involves 10 backpack gamma spectrometry systems with isotopic alarms which automatically transmit data for expert analysis. Mobile, and carried by security staff, it can perform multiple venue sweeps. Coupled with headset communication, nearby backpack carriers can approach the alarm site to confirm and triangulate sources of radioactive emissions. This capability was deployed to several major events in Canada and integrated into security operations to provide real time information to on-scene responders, and to cluster members at laboratories off-site.

In the current funding period, over 15 CRTI-led or funded exercises have been conducted across the science clusters with scenarios identifying capability gaps and areas where capacity needed to be bolstered. The CRTI exercises performed a critical role to ensure that investments are delivering effective S&T solutions to the federal, provincial, and municipal responders. They provided opportunities for officials from multiple layers of government and across sectors to gain experience working together and to coordinate interoperability between jurisdictions. Lessons from these exercises are integrated into the capability-based planning process. Summaries of two CRTI exercises: Bi-Ex West (October 2007) and Exercise Initial Thunder (Ex IT-08) (February 2008) are provided below, with a brief description of their objectives, relevance and results.

Summary 1

Biological Incident Exercise West (Bi-Ex West)	
Date/Locale	October 2007 in Delta, BC. Consisted of two tabletop exercises and one field trial—designed to enhance the capability of organizations in the Biological Cluster to respond to bioterrorist events.
Lead Department	PHAC and CFIA.
Partners	DND, PS, RCMP, BC Ambulance Service, BC Centre for Disease Control, BC Ministry of Agriculture and Lands.
Objective	To enhance the capability of participating organizations to provide a more efficient and coordinated response, across jurisdictions, to an emergency situation involving a zoonotic agent or disease transmitted from animals to humans.
Relevance	The exercise built on participants’ experience while preparing them to operate together if faced with a zoonotic bioterrorist incident. They focused on handling samples on-site, transporting samples to the National Centre for Foreign Animal Diseases laboratory in Winnipeg, and conducting forensic analysis and investigation.
Results	Bi-Ex West enabled participants to strengthen their skills, improve procedures, and identify vulnerabilities. It tested the preparedness of federal experts and their ability to work with other levels of government and emergency responders. It contributed to improving national capabilities to respond to bioterrorism threats.

Summary 2

Exercise Initial Thunder (Ex IT-08)	
Date/Locale	February 2008 in Vancouver and Victoria, BC.
Lead Department	DND (the DRDC/CRTI (RN Cluster)).
Partners	Atomic Energy of Canada Limited, Canadian Border Services Agency (CBSA), Canadian Nuclear Safety Commission, DND, EC, HC, NRCan, PHAC, PS, RCMP, and TC. BC Centre for Disease Control, BC Ambulance Services, BC Provincial Emergency Program, Vancouver Fire and Rescue Service, and Vancouver Police Department.
Objective	For federal, provincial and municipal responder teams to work together through scenarios to evaluate CBRNE counter-terrorism tools, systems, and procedures developed through CRTI investments. The exercise also focused on interdiction, prevention, and critical infrastructure protection (CIP).
Relevance	This exercise contributed to more efficient and coordinated responses to major emergency situations involving CBRNE threats.
Results	Teams of responders worked through scenarios to demonstrate the value and effectiveness of S&T solutions to aid responders in situations involving CBRNE threats. Lessons learned were integrated into preparations for the Vancouver 2010 Olympic and Paralympic Games and led to the integrated Science Town concept funded by CRTI.

Specific CRTI projects and investments in cluster capability have developed interoperability across laboratory clusters and levels of government. These interoperable systems have improved situational awareness and have led to an improved understanding of threats and risks. Two CRTI investments that have already influenced intermediate and long-term outcomes include BIO-049AP (Canadian Network for Public Health Intelligence (CNPHI) / Canadian Animal Health Surveillance Network (CAHSN) Infrastructure Upgrades) and CRTI 07-0150TD (Casualty Care Continuum from the Event Scene to the Hospital Emergency Ward). These are described in Examples 7 and 8.

Example 7

Canadian Network for Public Health Intelligence (CNPHI) / Canadian Animal Health Surveillance Network (CAHSN) Infrastructure Upgrades (BIO-049AP)
<p>Building on investments during the initial CRTI funding period, this project updated the infrastructure supporting CNPHI and the CAHSN. These networks, managed by PHAC and CFIA, respectively, are early warning systems which collect and process data about biological threats, communicate strategic intelligence, and facilitate the coordination of the national response. These tools are the first of their kind to enable federal, provincial, and regional health authorities to share this information in a secure manner and are used by more than 90 percent of Canadian public health authorities.</p> <p>By updating and upgrading this network, this CRTI investment has ensured the continued ability of animal and public health authorities to respond to events such as the 2008 Listeriosis outbreak where CNPHI issued an alert to public health units across Canada.</p>

Example 8

Casualty Care Continuum from the Event Scene to the Hospital Emergency Ward (CRTI 07-0150TD)

Led by DRDC in partnership with BC Ambulance Service, Canadian Red Cross, Queen Elizabeth II Hospital, Toronto Emergency Medical Services and the University of Ottawa Heart Institute, the objective of this project is to improve incident response by deploying a Mass Casualty Incident information management system. The system is integrated into the responder workflow and is designed to be interoperable with local systems. This tool improves communication among responders and stakeholders by providing a common access point for collecting and distributing casualty and other information, such as protective equipment and information about treatment and hazards.

This project has also leveraged other key initiatives, in the CRTI domain and externally, including the CRTI funded PROBE Crime Scene Support Tool Project (06-0317TD). Combined, these projects provide an integrated capability that allows a disparate set of responders from a number of communities to access data necessary for casualty management, intelligence gathering, forensic investigational tools, and the detection, identification, and attribution of CBRNE hazardous material to source.

CRTI outputs also contributed to informing the development of PS-led national public safety and security policies and strategies which seek to enable interoperable prevent, response, and recover systems. These included the CBRNE Resilience Strategy and Action Plan for Canada (2011), the Emergency Planning Guide (2010 – Federal All-Hazards Risk Assessment Framework), and the Communications Interoperability Strategy and Action Plan for Canada (2011). DRDC CSS is in support of or leading various action items from the Action Plans.

CRTI projects and activities have contributed to achieving immediate and intermediate outcomes in **Stream 3 “Public-Private Preparedness and Confidence”** of the Public Security S&T Logic Model. The established consolidated risk assessment and capability-based planning processes identify hazards, risks, consequences and vulnerabilities in local communities, businesses and levels of government. A goal is to increase Canadians’ awareness of safety and security risks and to enhance the confidence of Canadians in the ability of the Federal public security community to prevent, prepare, respond to and recover from high consequence events. In the CSS questionnaire, CRTI stakeholders indicated that DRDC CSS programs have positively contributed to public security behaviour relevant to prevention, preparation, response and recover activities with a response level rating between “Solid Contribution” and “Significant Contribution,” providing an above average rating score of 3.7 out of 5.0.

CRTI investments linked to **Stream 3 outcomes** include developing a framework for a pan-departmental All-Hazards Risk Assessment (AHRA) in response to the EMA. The EMA requires that departments conduct AHRA as part of the EMP cycle. In December 2006 the Intelligence Experts Group (IEG) on Domestic Security was created by the Privy Council Office (PCO). This group, representing 18 federal departments and agencies, was mandated to lead development of the AHRA. In 2007 CSS initiated a study to develop a harmonized AHRA in support of the IEG. Following consultations it was recommended that PS and PCO co-lead a two-year pilot initiative to develop the AHRA



Framework. This initiative will deliver the framework and first iteration of an AHRA and conclude in late 2011. This work is foundational to increasing public and private awareness of risk and vulnerability to high impact events, and will inform CRTI investments in Public Security S&T and Government-wide preparedness.

The involvement of the CRTI Psychosocial Cluster is important to achieve public-private confidence. This Cluster unites academia, government agencies, and volunteer associations toward increasing the preparedness and resilience of Canadians to terrorism, emergencies and crises. The Cluster enables CSS and partners to improve emergency plans by providing knowledge and expertise on the psychological and social consequences of crises. As this community becomes more established, additional investment in S&T capacity and capability will elevate public-private preparedness and work to achieve longer term outcomes. Two CRTI projects that support preparedness, public confidence and group behaviour and which contribute to **Stream 3 of the Public Security S&T Logic Model** include CRTI 06-0259TD (Psychosocial Risk Manager (PRiMer): Computer-based Pre-Event Training) and CRTI 08-0176RD (Enhancing Resilience Among High Risk Populations to Maximize Disaster Preparedness). An overview of these two projects is provided at Examples 9 and 10.

Example 9

Psychosocial Risk Manager (PRiMer): Computer-based Pre-Event Training (CRTI 06-0259TD)

Led by the University of Ottawa (GAP-Santé) and PHAC, this project uses technology and multimedia to provide a knowledge base to responders and planners to assist in the preparation, planning, and response to CBRNE threats or attacks. The project responds to a capability gap and the need to provide more psychosocial knowledge to the responder community. This need spans communications with the public, dealing with the media, coordinating between units, pre-event training, anticipating public reactions and building the public's confidence.

PRiMer training targets joint civilian and military security missions, group behaviours, collective decisions, and leadership in joint operations. It is anticipated that increased training of various stakeholders will enhance planning and preparedness for all hazards.

Example 10

Enhancing Resilience Among High-Risk Populations to Maximize Disaster Preparedness (CRTI 08-0176RD)

Led by PHAC in partnership with the University of Ottawa, Human Resources and Skills Development Canada—Office of Disability Issues, the Canadian Red Cross, the Government of Nova Scotia—Department of Community Services and Carleton University, this project is developing knowledge for resilience-oriented intervention programs. The project is also providing evidence on the effectiveness, appropriateness, and feasibility of community mobilization to mitigate social risk among population groups and to enable individuals and communities to improve their capacity to resist the negative impacts of a future disaster.

Finding

- CRTI projects and science cluster activities (such as workshops, exercises and training) are effectively building S&T capacity to address all-hazards risks.

CRTI Activity (2):
“Fund S&T to build capability in critical areas, particularly those identified through a Capability-Based Planning approach that looks at all-hazards risks.”

The capability-based planning processes require the inclusion of multiple levels of government and economic sectors in the planning process. Within this process, the development of all-hazards risk scenarios aids analysis of capabilities and identification of gaps by emergency planners, responders, and other stakeholders. The prevention of terrorist attacks requires increased vigilance from the public, the public service, and the private sector. In contrast, while natural disasters cannot be prevented, it is important that action to mitigate their effects be taken before they occur. The development of natural disaster scenarios helps to identify measures that can lessen property damage and casualties. Emergency planners use scenarios to implement safeguards against accidents and technological disasters. Risk scenarios help to identify where backup systems, fail-safe measures, and redundancies are needed to secure the continuity of critical infrastructure services. A common understanding assists all participants in the public safety and security domain to seek the best solutions to close capability gaps. CRTI stakeholders rated how DRDC CSS programs have contributed to Canada’s economic, public and national emergency management confidence with an above-average rating score of 3.33 out of 5.0, which lies between the positive response levels of “Solid Contribution” and “Significant Contribution.”

Since 1 April 2007, CRTI has funded 193 projects: 89 new S&T projects in response to four Calls for Proposals (Calls 6 to 9); and 104 S&T projects in the Technology Acquisition (AP) category were funded to support CRTI clusters. As seen in Table 2, of the 89 new projects, 68 (or 76 percent) remain in progress in mid-2011, while 17 (or 19 percent) were completed and 4 (or 5 percent) were cancelled.

CRTI Investment Priorities (FY 2006/07-FY 2011/12) RD, TD, and TA Projects	Cancelled Projects	Projects in Progress	Projects Completed	Total # Projects
C4I for CBRN Planning and Response	0	1	0	1
Equipping and Training First Responders	1	1	2	4
Immediate Reaction and Near-Term Consequence Management	0	3	1	4
Longer-term Consequence Management	0	2	1	3
Prevention, Surveillance and Alert Capabilities	0	3	2	5
System of Systems Approach to Capability Management	0	2	0	2
Risk Assessment and Priority Setting	0	7	2	9
Explosives – Threat and Capabilities	0	11	0	11

CRTI Investment Priorities (FY 2006/07-FY 2011/12) RD, TD, and TA Projects	Cancelled Projects	Projects in Progress	Projects Completed	Total # Projects
Medical and Casualty Management	1	6	2	9
Public Confidence and Psycho-Social Factors	0	7	1	8
Criminal and National Security Investigation Capabilities	0	10	6	16
Safety of the Food System	0	5	0	5
Emerging innovative CBRNE S&T	0	1	0	1
CBRNE Detection and Identification	2	6	0	8
Exploitation and Sustainment of Investments including Capability-Based Planning Validation	0	3	0	3
Totals:	4	68	17	89

Table 2. CRTI Projects Selected Through the Call for Proposals Process. This table displays the number of projects for each CRTI investment priority and their status.

During this funding period (since 1 April 2007), 60 percent of the projects selected via Calls for Proposals were devoted to five investment priority areas:

- Risk Assessment and Priority Setting
- Explosives – Threat and Capabilities
- Medical and Casualty Management
- Public Confidence and Psycho-Social Factors
- Criminal and National Security Investigation Capabilities

This prioritization is reflective of the consolidated risk assessment and capability-based planning processes and of the quality of proposals and perceived benefits to the Canadian public. This bias of funding across priority areas also corresponds to the composition of CRTI following funding renewal in 2007. With the inclusion of the Explosives Cluster since 2007 there has been a marked shift towards investments in Explosives Threat and Capabilities. Additionally, investments in Medical and Casualty Management, Public Confidence and Psycho-Social Factors, and in Criminal and National Security Investigation Capabilities have aimed to enhance the resiliency of the Canadian public and first responders in dealing with high-consequence events.

As CRTI-funded S&T projects are multi-year, many remain ongoing with only a small proportion having been completed. Challenges to completing projects, aside from the development of S&T, occur during the “project kick-off phase” and as a result of operational requirements. Delays in contracting, the complexity of negotiating agreements with multiple project partners, and delays caused when scientists are called away to deal with operational requirements (i.e., H1N1, SARS, major events including Vancouver 2010, and responding to local and regional emergencies) have also caused schedule slippage.

From the 193 total projects awarded funding during the current funding period, the synopses of five examples are summarized at [Annex F](#) to show their relevance, progress, results and impact toward building capabilities in critical areas. The projects highlighted are as follows:

- Development of Standards for Decontamination of Buildings and Structures Affected by Chemical or biological Terrorism (CRTI 04-001RD);
- Development of a Canadian Standard for Protection of First Responders from CBRN events (CRTI 05-0016RD);
- Portable Biological Agent Detection Systems (CRTI 06-087TD);
- Portable Electronic Microarrays for Agro-bioterrorism: Detection and Typing of high Consequence Agents (CRTI 07-0132TA); and
- CBRN Crime Scene Modeler C2SM-Fast (CRTI 07-0216TA).

Finding

- CRTI is providing the S&T and operational communities with enhanced capabilities and knowledge in critical areas that increase Canada's preparedness for a wide range of risks.

CRTI Activity (3):

“Provide funds to those areas where national S&T capacity is deficient owing to obsolete equipment, dated facilities or insufficient resources.”

Science clusters, which include both the laboratory and response communities, develop capabilities to support their response roles. Funding of cluster activities to build S&T capacity is determined at the cluster level based on their assessed priorities. Each cluster identifies and prioritizes its most pressing gaps and the technologies, activities or equipment needed to bolster their response capacities and capabilities. AP project funding is then apportioned between clusters based on need, risk and other relevant factors and is subject to a competitive contracting process.

The sources of funds for AP projects are “Vote 1” – Operations and Maintenance and “Vote 5” – Capital acquisitions. Vote 1 funds support activities, e.g., cluster-based exercises, workshops, training and maintenance. Vote 5 funds support acquisitions and usually involve the procurement of commercial off-the-shelf technologies.

Cluster activities, such as exercises and workshops, inform investment decisions via lessons learned or knowledge gained. Three CRTI projects which have contributed to achieving immediate and intermediate outcomes in **Stream 1 “Enabling Public Security Capabilities” of the Public Security S&T Logic Model** include (1) technology for the detection of bioterrorism agents using bacterial or viral DNA/RNA in the field (BIO-056AP); (2) a tool to populate a chemical profile database that can be shared between departments and forensic, biological and materials science laboratories (EX-007AP); and (3) surveillance capabilities to detect radioactive materials and screen personnel at checkpoints (RN-047AP, RN-080AP, RN-081AP). Synopses of these are at [Annex G](#).

Through cluster activities, effective capacity in federal laboratories is being built through CRTI-funded acquisitions, knowledge-sharing and community building. These CRTI equipment purchases and activities contribute to the achievement of immediate and intermediate outcomes in **Stream 2 “Interoperable Prevent-Response-Recover Systems”** and **Stream 3 “Public-Private Preparedness and Confidence.”** In regards to increasing laboratory capacity, CRTI stakeholders rated the importance of CRTI funding in relation to their own organization’s funding, and provided an above average score of 4.2 out of 5.0, which lies between the positive response levels “Very Important” and “Extremely Important.” In comparison to other government funding for collaborative S&T projects, CRTI funding received a similar positive average score of 4.2 out of 5.0.

By having an increased understanding of existing threats and an increased capacity to identify emerging threats, cluster members are better positioned to prevent, prepare for, respond to and recover from high-consequence events. In addition, the resilience and adaptability of the community, individuals, family, workers, organizations and the overall social fabric before, during, and following a high-consequence event remains a priority. The CRTI-funded activities are providing enhanced situational awareness that support intermediate outcomes by creating trans-jurisdictional national security situational awareness systems, supported by policy and strategies.

Finding

- CRTI funding is building the capacity of science clusters through acquisitions and a wide range of knowledge-sharing activities.

CRTI Activity (4):

“Accelerate technology into the hands of responder communities and other operational authorities.”

TA projects, at the highest end of the R&D continuum, have the greatest impact on CRTI outcomes related to transitioning and exploiting S&T investments for the responder community. Prior to CRTI funding a TA project, a market is confirmed; either the technology can be purchased “off the shelf” or must be developed. TA projects require a lead federal department partner, a private sector partner, and one from the emergency responder or operational community. The success of TA projects depends on the inclusion of relevant partners throughout the investment process. As a project partner, the responder community ensures there is a continued need for the capability and that the developed product meets the intended requirements.

CRTI projects and activities have contributed to achieving immediate and intermediate outcomes in **Stream 2 “Interoperable Prevent-Response-Recover Systems”** and **Stream 3 “Public-Private Preparedness and Confidence” of the Public Security S&T Logic Model.** Examples 11 and 12 are two CRTI projects that link responders through interoperable systems and build public-private confidence.

Example 11

PROBE – Crime Scene Support Tool (06-0317TD)

PROBE combines commercial and CRTI-developed software products to create an integrated and expandable CBRNE Crime Scene Support Tool for Police, EMS and HAZMAT personnel. This project, led by CPRC and the RCMP Bomb Data Centre, increases responder preparedness by providing a field portable knowledge base to identify precursor materials for CBRNE events; render-safe procedures, tools to support triage of CBRNE casualties, incident management forms to support subsequent criminal investigations, and plans and training material to support the medical community's response to RN events.

Participation in PROBE exercises brought together traditionally independent organizations from the Police, Fire and emergency medical services into a single operating construct where resources and capacities were managed under unified command. This expanded their perspective on joint operations and mutual aid considerations in response to a CBRNE incident and subsequent investigations.

Example 12

ASSET: Advanced Syndromic Surveillance and Emergency Triage (06-0234TA)

Syndromic surveillance is the use of real-time data gathering and analysis to identify disease outbreaks, both natural and from bioterrorism. ASSET, led by the University of Ottawa Heart Institute, includes a real-time outbreak and disease surveillance “information exchange platform” which can interface with CNPHI and be adapted for use in any community. This add-on to the CNPHI system enables municipal and regional authorities to monitor health events and feed data into the CNPHI system.

ASSET is complete. It has been successfully deployed in Ottawa and in Grey-Bruce County, Ontario, with data collected from 13 community hospitals and directed to the Grey-Bruce Health Unit.

With inclusion of “Exploitation and Sustainment” as an investment priority area in the CRTI Call for Proposals, and a commitment to balancing project selection more evenly across the TRL, the CRTI is working to ensure that projects in the RD and TD categories advance to the stage where S&T can be transitioned effectively to the responder community. CRTI stakeholder respondents to the CSS questionnaire rated the extent to which DRDC CSS Programs have contributed to public safety and security emergency planning, responder and receiver S&T advancement with a positive rating of “Significant Contribution,” and an above average score of 4.0 out of 5.0.

Finding

- CRTI investments have developed, and continue to develop, technologies that directly support responder communities and operational authorities.

CRTI Involvement in Recent National and International Events—Support to the 2010 Winter Olympics, G8 and G20 Summits

The Vancouver 2010 Olympics, and the G8 and G20 Meetings in Huntsville and Toronto, Ontario, demonstrated how CRTI investments provide S&T operational capabilities to first responders. CRTI was prominent during the planning for these three international events at the federal, provincial, and municipal levels.

CSS developed an innovative concept for international events via the MECSS project, and the support of CRTI clusters and funding were critical to its success. Table 3 provides a brief description of the MECSS project:

Project Name	Description of Major Events Coordinated Security Solutions (MECSS) Project
Overview	The complexity of issues to address potential CBRNE threats to the Vancouver 2010 Olympics and the G8 and G20 events required a high degree of expertise and coordination from all levels of government. The capabilities and experience stemming from CRTI investments aided the security partners in planning, preparing and exercising for a CBRNE event.
Relevance	The MECSS project was a multi-agency collaborative partnership established to reduce the security risk to the three international events. Implemented within the PSTP, under DRDC/CSS, it spanned science clusters and COPs, and mobilized science laboratories.
Impact	<p>MECSS enabled support to the following partners: PS, RCMP Major Events Section, Vancouver 2010 Olympics Integrated Security Unit, the BC Integrated Public Safety and the CF Joint Task Force Games.</p> <p>Products with CRTI support included:</p> <ul style="list-style-type: none"> • a federal CBRNE Capability Inventory; • a federal CBRNE Concept of Operations (CONOPS); • a federal CBRNE Protection Plan for the Vancouver 2010 Olympics; • a CBRNE Capability and Gap Analysis for BC; • a CBRNE Consequence Management Plan for BC; • a CBRNE Sensor Placement Study to support the CF in Vancouver; • CBRNE training support to provincial and municipal organizations in lower mainland BC; • support to a whole-of-government CBRNE Table Top Exercise; and • “Science Towns” at the Whistler and Vancouver venues and the G8/G20 event locations.

Table 3. Description of the MECSS Project. This project was a multi-agency collaborative partnership that was established to reduce security risks.

MECSS epitomized the “operationalizing” of CRTI investments since the program’s inception. The Science Towns, in particular, brought together CBRNE resources from DRDC, EC, PHAC, HC, NRCAN, and the Director General Nuclear Safety (DND/CF). CRTI-funded resources for the Science Towns included science experts, advisors, specialists, equipment and mobile laboratories. The Science Towns supported the RCMP National CBRNE Response Team. These signalled a maturation of CRTI projects—from the development of S&T technologies to the provision of deployed operational capabilities for CBRNE counter-terrorism.

DRDC scientists made major contributions to planning and operations in key areas such as command and control, blast effects, vehicle and personnel screening, CIP, CBRNE and exercises, and marine surveillance.³³ This has led to the creation of an enduring framework to support interoperability between partners at multiple levels of government both prior to and during a major event.

The MECSS project and the mobile laboratory capability (the basis of Science Town) enabled the leveraging of national S&T resources to strengthen the GoC's major events security architecture. The project's focus was on reducing risks associated with major events through the coordinated application of deployed S&T tools, support, and services, while providing key input to the broader major events security architecture being developed by the RCMP. After the 2010 Olympics, the MECSS was activated for the G8 and G20 meetings.

The framework developed under MECCS has endured, as pieces were also activated during the Canadian government response to the 2011 earthquake and tsunami in Japan. Members of the CSS were embedded into the GoC operations centre to enable reach-back to the science clusters.

Post-event reports indicate S&T contributed significantly to the overall reduction of security risks associated with the three international events. The development and success of the MECSS and "Science Town" deployed capabilities received national and international recognition. This same capability is being replicated by UK authorities for the 2012 Olympics in London.

CRTI Funded S&T Support in Response to Events in Japan

In response to the 2011 earthquake and tsunami in Japan, CRTI investments were deployed internationally and domestically to contribute to the safety of Canadians and the international community. This was possible due to the transition of CRTI investments to both responders and operational authorities responsible for coordinating the Canadian response.

When the CRTI RN Cluster was created, its structure mirrored that of the Technical Advisory Group (TAG) of the Federal Nuclear Emergency Plan (FNEP) in order to support operations during a potential event. The FNEP, led by HC, provides the structure for federal nuclear emergency preparedness and response. While the FNEP was not activated to support the Government Operations Centre in Ottawa during the events in Japan, many of the technical support functions conducted through the FNEP's TAG were informally activated to support operations. This led to the deployment of personnel and equipment to BC to support Emergency Management BC.

The CRTI-funded, HC-led "Accident Reporting and Guidance Operational System" (ARGOS) (CRTI Project 01-0080TA) operated throughout the Canadian response to the events in Japan. This capability enhanced national situational awareness by integrating data from an array of monitoring and surveillance tools. In response to the evolving

³³ DRDC CSS TR 2010-999 December 2010 (Major Events Coordinated Security Solutions (MECCS)).

situation at the Fukushima Daiichi Nuclear Plant, a CRTI-funded “Fixed Point Surveillance System” (CRTI Projects RN001AP and RN010AP) reported continuously and 11 fixed-point detectors were deployed, with two located at the Canadian Embassy in Japan and nine in BC. The detectors ensured that the GoC had timely and accurate information on which to base its response as the crisis evolved. As well, 5000 CRTI-acquired dosimeters (CRTI Project RN-0046AP) were deployed to Japan and distributed in support of detection efforts and to assist with the protection of Canadians. Domestically, NRCan conducted aerial surveillance in BC (CRTI Projects: RN002AP and RN 0012AP) while EC dispersion models, partly developed through CRTI Projects 02-0093 RD and 07-0196TD, operated alongside the Acquisition of Meteorological Data (PAN 0001AP). As well, five CRTI-funded Mobile Nuclear Laboratories (CRTI Projects: RN007AP and RN044AP) were on standby to deploy domestically or internationally.

S&T investment and the community-building activities of the RN cluster underpinned support to GoC during the Japan crisis. CRTI investments provided tools to the operational community and the interdepartmental RN community supported operations. This response demonstrated the level of Canada’s preparedness to address aspects of a high-consequence RN event and should inspire public confidence if such an event were to occur in Canada. The S&T community demonstrated that it is well positioned to respond.

Finding

- S&T investments were deployed effectively to support the security of major international events hosted in Canada and to assist the GoC response to a nuclear crisis in Japan. In this funding period, CRTI directly supported the successful development and operationalizing of S&T investments which contributed significantly to the safety and security of Canadians.

CRTI Communications and the Dissemination of Knowledge

CSS information sharing and communications initiatives involving CRTI are embedded within the four CRTI mandate objectives. During the current funding period, CSS communications-related products have primarily targeted the S&T community and first responders, with limited products available to the public. Communications products and activities include:

- **Annual S&T Summer Symposium.** CSS organizes an annual Public Security S&T Summer Symposium for federal, industry and academic S&T partners. CRTI projects within the broader PSTP are one component of the Symposium. Updates on projects approved in previous rounds of funding are presented, outlining the objectives, relevance, results and key partner information. The Proceedings of the Symposium are published and made available on the Internet for public review.
- **Annual Reports.** During the initial funding period, until FY 2006/07, DRDC published a CRTI Annual Report which provided an overview of CRTI governance, the year’s key activities, details on funding distribution, and advances in capacity and capabilities, including investment priorities and project partnerships. Most significantly, the annual reports detailed how CRTI project



outputs aligned with CRTI intermediate outcomes. In 2007, CRTI also published “Five Years of Knowledge Creation – A Biography of CRTI Project Publications.” With the creation of the CSS in 2007, it was decided that annual reporting would cover not only the CRTI, but all programs managed by the CSS. However, for the four years from FY 2007/08 through to FY 2010/11, the CSS did not produce any annual reports. Instead, a CSS overview report covering the years 2002-2010 was released in 2011, titled “From Concept to Capability: Enhanced Public Security through Collaborative S&T, 2002-2010.”

- **Intranet.** The evaluation team was advised that CSS is in the process of adopting a new SharePoint system as a renewed CSS portal to disseminate information and knowledge within the S&T community.
- **Internet.** Through the CSS Internet site, details concerning the CRTI are available through associated links. As the Internet is the primary means for the public to access information about the CRTI and its associated activities, it is important that the details be complete and up-to-date. (<http://www.css.drdc-rddc.gc.ca/crti/about-sujet/index-eng.asp>).
- **Professional Journals and Other Media.** Expertise, knowledge and lessons relating to public safety and security issues have been disseminated and published in professional journals. Videos are produced describing the operational results of projects, and promoting their use to potential end-users. DRDC also produced a promotional video targeted at decision makers. Press releases are disseminated regularly.

CSS staff expressed concern that the design of some communications products sent to external stakeholders predominantly reflects a DRDC focus on support to the CF which can provide those stakeholders with an incorrect perception of a DND or CF bias to CSS or CRTI projects and initiatives. Although the CSS is one of nine DRDC research centers, it has a unique pan-departmental mandate and focus, and routinely sends communications products which reflect the activities of all participating GoC departments.

Finding

- The CSS informs the public and stakeholders of CRTI activities and supports knowledge sharing across the policy, S&T, and responder communities. More extensive use of the Internet and Intranet could provide additional opportunities, which have not yet been exploited by the CSS, for knowledge sharing and decision making.

Recommendation

1. Promote more extensive use the Internet and Intranet, within security constraints, to disseminate information about CRTI projects and activities. Initiatives that could be implemented may include searchable databases of CRTI investments and links to the outputs and outcomes of funded projects.

OPI: ADM(S&T)

Finding

- The design of CSS communications products reflects a DRDC focus, whereas CSS Public Security S&T projects and activities are pan-departmental.

Recommendation

2. Design CSS communications products (including logos/headers) to reflect its pan-departmental public safety and security focus.

OPI: ADM(S&T)

Issue 5: Demonstration of Efficiency and Economy. Assessment of resource utilization in relation to the production of outputs and progress toward expected outcomes.

Determining the efficiency of the CRTI involves examining costs and the quantity, quality, timeliness and appropriateness of the program's outputs. Efficiency is also linked to the program design and delivery approaches, consideration of the program's context, risks and assumptions, and the processes used in creating the CRTI outputs. Determining the economy of the program involves assessing CRTI costs to undertake activities to create outputs in support of CRTI outcomes. It also involves determining the extent to which CRTI managers have engaged in practices that have contributed to cost minimization, managing for results, and the consideration of alternative models.

Governance

Endeavouring to fulfill the objective of a harmonized governance structure, the CSS-led governance construct has been in a state of evolution and refinement during the current funding period. As the majority of CSS-led projects are multi-departmental, a pan-departmental governance framework was established through the creation of the Public Security S&T Steering Committee (PSST SC)³⁴ and the Public Security S&T Program Management Board (PSST PMB) (refer to Figure 4).

The PSST SC was formed to provide broad oversight of the CRTI, Pstp and CPRC programs and to endorse CRTI investment priorities, develop strategic policy, and provide oversight of financial activities. As outlined in the 2008 MOU between DND and 21 other Federal Departments and Agencies concerning the CSS and Public Security S&T, the PSST SC provides strategic and directional guidance to the CSS. The evaluation team was advised of the intention to have the PSST SC co-chairs issue Strategic Planning Guidance (SPG) to the Director General (DG) CSS annually, to outline priorities and to ensure PSTP alignment to GoC public safety and security issues. During the current funding period (as of end-FY 2010/11), a SPG document had not yet been issued by the PSST SC. The evaluation team was informed that a SPG, in draft

³⁴ This is also referred to as the Public Security Technical Program Steering Committee (PSTP SC). While the 2006 Program Renewal document stated that the PSTP SC's name is changed to the PSST SC to reflect a broader public safety and security community, CSS and CRTI documentation, including the 2008 interdepartmental MOU, refers to the PSTP SC. The evaluation will use the term "PSST SC" as outlined in the 2006 Program Renewal document.

form, was being finalized as of June 2011. In addition, the creation of an advisory board to advise the PSST SC co-chairs on PSTP balance, direction and value, was also referred to in the 2008 MOU. During the current funding period (as of end-FY 2010/11) an advisory board had not yet been established, although it was reported that its terms of reference are under review.

The PSST SC is co-chaired by the ADM(S&T) in DND and the ADM of Emergency Management and Regional Operations in PS. The PSST SC membership is at the ADM level, representing TBS, PCO and each of the 19 participating federal departments and agencies that are signatories to the 2008 MOU. The PSST PMB is co-chaired by the DG CSS and the DG Emergency Management Policy in PS. The PSST PMB provides operational oversight of the CRTI and Pstp, with a focus on performance and program balance. Its member-designates are the appropriate DGs or Directors of participating federal departments. However, according to multiple informants, the PSST SC, in its present configuration, has not been as effective as originally envisioned. Issues include the challenge of supporting a large interdepartmental steering committee that requires administrative coordination, issue tracking and agenda development for intended biannual meetings, and the difficulty of engaging ADM-level attendance at PSST SC meetings from the departments and agencies, especially when only a select number of departments are deemed to have a fundamental stake in core PSTP business. Alternatives to the present construct are under consideration, and the existing GoC public safety committees or security fora may be considered as an option to meet PSTP governance requirements.

Finding

- The PSST SC has not been effective with the present governance construct. The intent of the PSST SC to promulgate top-down direction in the form of a strategic guidance document has not been realized. The anticipated advisory board, as described in the 2008 interdepartmental MOU, has not been established.

Recommendation

3. Develop and implement an effective and administratively supportable governance construct.

OPI: ADM(S&T)

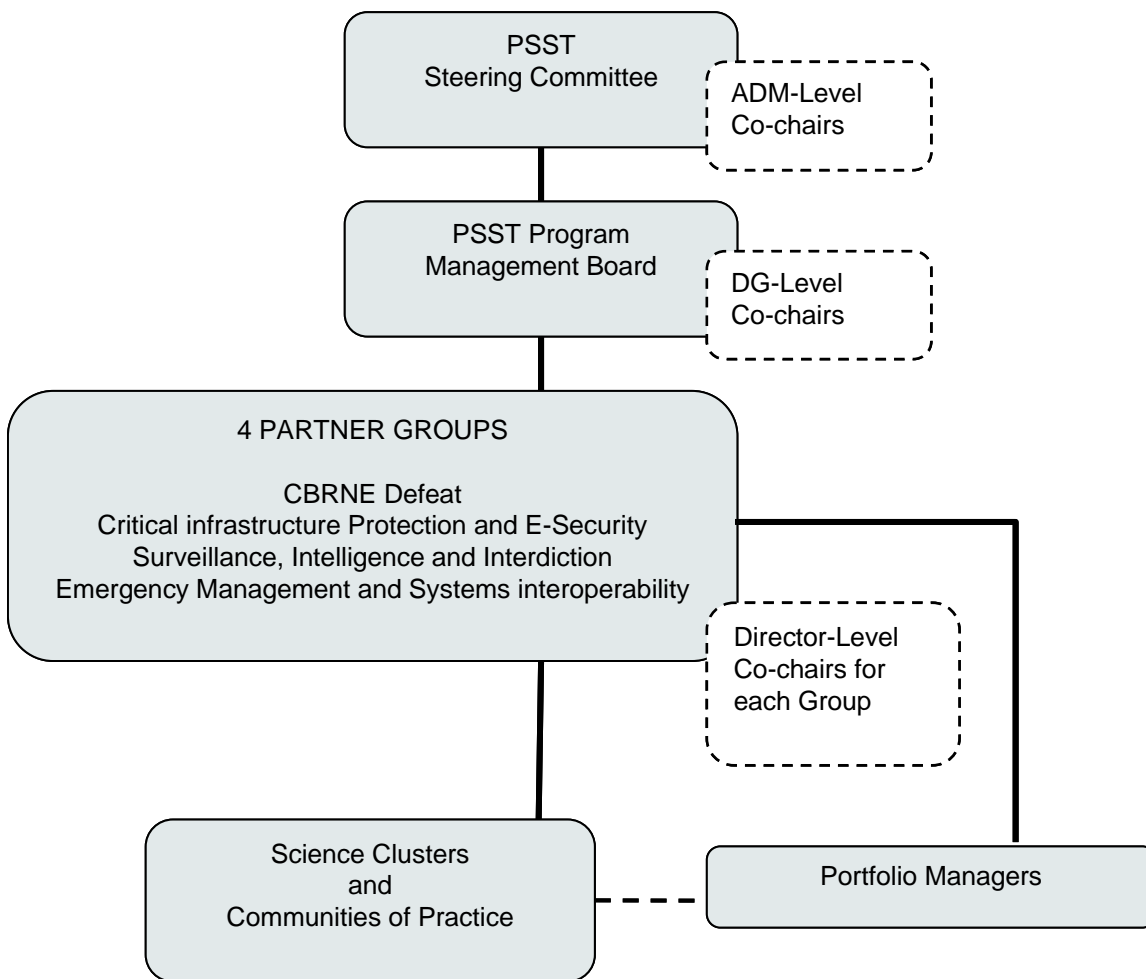


Figure 4. PSTP Governance Structure. This figure provides an overview of the governance relationship between the PSTP components.

In 2010, the PSTP governance model changed to comprise four Public Security Partner Groups³⁵: CBRNE Defeat, CIP³⁶ and E-Security, SII, and EMSI.³⁷ The CIP, SII and EMSI Partner Groups correlate to the Pstp mandate to allow for balanced input from PS across all public safety and security domains.

Each Partner Group is co-chaired by the DSTPS and a representative from PS or another federal department. These co-chairs interface between the DG CSS, who is Science Advisor (SA) to the ADM S&T for Public Security S&T issues, and the science clusters. They also assist the SA in formulating the Partner Group component of the Public Security S&T program. Through the production of an annual Mutual Partner Agreement, Partner Groups contribute to the CRTI investment priorities process.

³⁵ The Partner Groups have also been referred to as “Working Groups” in some CSS documentation.

³⁶ The 2008 CSS & Public Security S&T MOU between DND and 21 MOU participants refers to this as “CIP.” The DRDC Business Line 3 Program refers to it as Physical and Cyber Critical Infrastructure Protection.

³⁷ The 2008 MOU between DND and 21 MOU participants refers to this as “Emergency Management and System Integration” (EMSI); however, the DRDC Business Line 3 Program refers to it as “Emergency Management System and Interoperability” (EMSI).

The policy, mandate, programs, governance, organization, business management, financial management, operational management and procedures for the provision of services in support of Public Security S&T are dispersed between the latest CRTI Call for Proposals Bidder Guidebook, the CRTI Project Implementation Guide, the DRDC Business Line 3 Mutual Partner Agreement, the previous program renewal document, and the applicable PSTP MOUs. One of the products of these multiple source documents is an inconsistent use of terms relating to governance and Public Security S&T, many of which have been highlighted in footnotes throughout the evaluation. The last attempt to create an overarching foundational document, as a single reference point for other amplifying CSS documents and instructions, was in 2007.³⁸

Finding

- The CSS lacks a single comprehensive and cohesive framework document which explains the organization's provision of services in support of Public Security S&T.

Recommendation

4. Establish a CSS framework document as an overarching foundational document for other amplifying CSS documents and instructions, with a regular multi-year review cycle to ensure its continued applicability.

OPI: ADM(S&T)

Finding

- There is a lack of consistency in the use of acronyms, nomenclature and descriptions throughout the CSS and CRTI documentation.

Recommendation

5. Ensure key publications, guides and Internet and/or Intranet sources of information, which are fundamental to understanding the Program and its organization and processes, are current and that the terminology is consistent.

OPI: ADM(S&T)

Each science cluster in the “CBRNE Defeat” Partner Group is chaired by a Cluster Leader. Cluster Leaders are normally selected from government departments that have a mandate corresponding to the cluster focus. For example, the Cluster Leader of the Chemical Cluster is presently from EC and the Co-Leader is from TC. Cluster Leaders are responsible (through the Partner Group Co-chairs) to the PSST PMB and work closely with the CRTI Portfolio Managers to compile and represent S&T priorities through user, policy and operational imperatives. Expertise specific to each cluster area is well represented inside the CRTI Clusters. However, expertise in medical issues is unequal between CRTI Clusters because each conducts its own medical countermeasures and medical casualty management projects. Hence, as each Cluster acts as an advisory body, an individual cluster may potentially have information regarding medical issues

³⁸ CSS Framework Document (Version 3.0), May 2007.

which affects its cluster, but in which cluster members may not have the interest or the expertise to pursue. As per the ability to detect various CBRN agents and to decontaminate personnel and equipment, the treatment of casualties and the preparation of first receivers is a critical component of the scenario spectrum. As medical responses to the range of potential CBRNE incidents involve many of the same resources and could operate under plans or procedures that have similar requirements, there is the potential to develop a unified approach to medical issues and first receivers across all clusters, including medical casualty management, through a dedicated Medical Cluster.

Finding

- The potential for a disjointed approach to medical issues exists within the present cluster construct.

Recommendation

6. Establish a coordinated S&T approach to medical issues; consider the development of a Medical Cluster.

OPI: ADM(S&T)

CRTI Project Selection

All CRTI projects, whether initiated through the Call for Proposals process or through cluster Business Plans, are required to align with at least one of the CRTI investment priorities. This requirement is outlined in both the comprehensive CRTI Call for Proposals Guidebook and the Public Security S&T MOU. The Guidebook includes information on the CRTI investment priority areas, instructions on how proposals are prepared, the screening and evaluation criteria and financial considerations. In addition to alignment with the investment priorities, all proposed CRTI projects have the following requirements:

- demonstrate how they link to the scenario spectrum (prevent, prepare, respond, recover);
- be mapped against a TRL; and
- achieve objectives in accordance with three defined CRTI Project Categories: RD, TD, or TA projects.

Each bid/proposal is first evaluated on its technical merits by external independent expert reviewers selected from the CBRNE, forensic, psychosocial, public safety and security, counter-terrorism, emergency incident responder, and operational communities based on their knowledge and expertise in CBRNE S&T and knowledge of end-user requirements. These experts provide the CRTI Proposal Selection Committee with an independent assessment of each proposal based on technical criteria for each project category. This Committee, in turn, is constituted by experts from the federal S&T and operational communities, industry, academia and PWGSC. Based on an assessment of factors designed to achieve a desired program outcome, specific project proposals are then selected and recommended for CRTI funding.



CRTI project selection is a three-stage process, and the information from Stages One and Two is used to establish a list of pre-qualified bidders:

- **Stage One—Proposal Synopsis Process.** PWGSC prepares and posts a Notice of Proposed Procurement on the Government Electronic Tendering Service. Proposal synopses submitted by the bidders are screened, reviewed and evaluated by the PSC. Successful bidders are then invited to submit a full proposal.
- **Stage Two—Full Proposal Process.** The full proposals are evaluated by independent expert reviewers who submit their recommendations to the PSC. The PSC then evaluates each proposal based on technical mandatory criteria, technical point-rated criteria, the expert reviews, and the CRTI investment priorities. Recommended projects are provided to the PMB for review and approval.
- **Stage Three—PWGSC Contracting.** The lead federal department for each selected project becomes the Technical Authority responsible for initiating a requisition for goods or services to PWGSC. Upon receipt of the approved requisition, Statement of Work, signed project Charter and Security Requirement Checklist, the PWGSC Contract Authority sends a Request for Proposal letter and proposed contract, and obtains assurances that the bidder has the necessary technical, financial and managerial competencies to conduct the contract. The approved project teams then attend a CRTI Project Implementation Workshop to receive guidance on the set-up, execution and close-out of their research activities.

Other departments and agencies, such as PWGSC (for the Canadian Innovation Commercialization Program) and the Canadian Nuclear Safety Commission, have recently sought CSS advice to adopt the CSS/CRTI project procedures for their own requirements. In addition, building on its experience with the CRTI project selection processes and development of the Investment Priority List, CSS is using this knowledge in other initiatives:

- CSS is further developing the AHRA framework to enable other levels of government and economic sectors to integrate into a national capability-based planning process;
- CSS is developing the “Target Capability List – Canada”³⁹ (TCL-C) which identifies tasks that must be completed to ensure preparedness for pre-critical and post-critical incident response. The TCL-C comprises numerous capabilities that address all stages of the event continuum and provides a quality assurance method to guide decisions related to investments, planning and management. The CRTI investment priorities are being linked to the TCL-C; and
- CSS is working with PS to link national strategies and action plans with other capability-based planning initiatives.

³⁹ The US Department of Homeland Security has advanced the application of capability-based planning through the development of the US Target Capability List. The Target Capability List describes the capabilities related to four mission areas: Prevent, Protect, Respond, and Recover. It defines and provides the basis for assessing preparedness. It also establishes guidance for preparing for major all-hazards events.



Informants noted that the latest Call for Proposal, Call 9, solicited a high number of very high-quality proposals, many of which could not be selected due to overall funding limits or a need to maintain an investment balance across the range of investment priorities. Although projects are selected through a competitive PWGSC-compliant process, focused by specific CRTI investment priorities and constrained by available funding, some informants expressed dissatisfaction with the process. Concerns included whether the number of investment priorities was too great, dissatisfaction with the scoring by external reviewers, the significant amount of time that often lapsed between project selection and project implementation, and the high turnover of PWGSC supply officers assigned to CRTI projects which has sometimes contributed to lengthy delays.

Findings

- The CRTI Investment Priority process focuses S&T projects to meet the security and public safety needs of Canadians.
- CRTI project selection is conducted through a comprehensive and transparent, yet very time-consuming, process which meets PWGSC requirements. The CSS has also encountered procedural delays due to process requirements and PWGSC staff changes.

Recommendation

7. Develop options that better meet CSS contracting requirements and mitigate delays in the contract processes.

OPI: ADM(S&T)

CRTI Performance Measurement

Each approved CRTI project has a Project Charter which, *inter alia*, defines the responsibilities between DND and project partners for each CRTI project and outlines the quarterly requirement for project performance measurement information. The federal department or agency that leads a project appoints a Project Champion and a Project Manager. Partners involved in delivering a project form the project team and support the Project Manager in project execution.

The Project Manager is accountable to the Project Champion and is responsible for project execution according to agreed objectives, schedules and resource commitments articulated in the Project Charter. The Project Manager is responsible for the completion and submission of Quarterly Project Progress Reports to the lead or sponsor department's Project Review Committee, to the CRTI Portfolio Manager and to the DSTPS. The CSS Secretariat consolidates the CRTI projects' performance measurement data into dashboard-style displays for comparison purposes and review of project status by CSS staff.

The Project Review Committee, which includes the CRTI Portfolio Manager as a member, is chaired by the lead department's Project Champion. Each CRTI project is reviewed annually by a Project Review Committee. This review includes approval of changes to the schedule and cash profile, addressing other exceptional circumstances that



cannot be resolved by the project team and, when necessary, recommending changes in the project's profile for approval to the PMB. The PRC may also recommend that a project be cancelled.

In addition to listing descriptive project information, each Quarterly Project Progress Report requires an assessment of the Project Management Status against the Project Plan outlined in the Charter. The assessed subjects include the following:

- **Technical Milestones**—explaining the achievement of technical milestones of the S&T against the Charter;
- **Schedule (slippage)**—indications if the Project is on schedule and if not, details of the recovery plan;
- **Cash Flow**—indications if the Project will expend the CSS funds allocated and if not, details why and the recovery plan; and
- **Risk Avoidance**—itemizing the risks to the Project, including risks identified in the Charter and unforeseen risks that may apply. Criteria include risk status, the actual or potential impact and how the project plans to avoid or minimize the impact of risk.

The Quarterly Project Progress Report also requires an assessment of the project success to date, against the outcomes stated in the Charter. Some of these categories include the following:

- **Need**—explanation of the current client need and/or market need for the S&T being developed with an indication of whether it has increased or decreased since the project inception;
- **TRL Maturity**—explanation of whether the TRL maturity of the S&T has increased or decreased since the Project inception; and
- **Deliverable Status**—identification of the current status of deliverables as outlined in the Charter.

Until FY 2008/09, CRTI was also required to report the performance of PSAT-funded activities to Treasury Board annually, through the Public Security Initiatives Annual Reporting Process. This annual report included sections on the progress, performance, risks, issues and assessments of the program activities. The 2008-09 report indicated that CRTI had renewed its performance indicators for both long-term and intermediate outcomes, and activity-based indicators for the immediate outcomes, but did not outline performance measurement criteria.

In support of the performance measurement of programs, TBS has issued the guide "Supporting Effective Evaluations: a Guide to Developing Performance Measurement Strategies"⁴⁰ which notes that a Performance Measurement Strategy should include a Program Profile, a Logic Model, a Performance Measurement Strategy Framework, and an Evaluation Strategy. The guide outlines the key content of performance measurement strategies, provides a recommended process for developing clear, concise performance measurement strategies, and presents examples of tools and frameworks for that purpose.

⁴⁰ <http://www.tbs-sct.gc.ca/cee/dpms-esmr/dpms-esmr00-eng.asp>.

Findings

- To monitor efficiency, CRTI has established regular and reliable quarterly progress reporting for each CRTI project and activity. The quarterly reports monitor and track technical milestones, timelines, costs and risks. Costs can be associated with each output.
- Neither the CSS, nor the CRTI as the funded program, have developed a Performance Measurement Strategy which outlines all performance measurement responsibilities, procedures and authorities for the Program.

Recommendation

8. Develop a consolidated Performance Measurement Strategy and Performance Measurement process, in accordance with the TBS Guide “Supporting Effective Evaluations: a Guide to Developing Performance Measurement Strategies,” for the CSS-led Public Security S&T Program, which includes the CRTI.

OPI: ADM(S&T)

CRTI Financial Management

Accountability. Derived from the GoC PSAT designated funding, CRTI funding is referred to as being “protected” or “fenced” which means it cannot be used for other departmental purposes. In addition, CRTI-designated funding is only applicable to CRTI projects. CRTI funding cannot directly support Pstp or CPRC activities; however, where CBRNE threats or events impact or are impacted by Pstp activities, there can be funding overlap. Some examples include interoperability of first responders during a CBRNE event; effects of CBRNE on critical infrastructure; and the ability of surveillance, intelligence or interdiction to prevent against, or prepare for, a CBRNE event.

Within DND, the funds earmarked for the CRTI are transferred from the Assistant Deputy Minister (Finance Corporate Services) to ADM(S&T), who is accountable to the Deputy Minister for the financial performance of CRTI. ADM(S&T), in turn, has delegated the authority for oversight of CRTI funds to the DG CSS. Within CSS, the responsibility for daily management of CRTI funds lies with the DSTPS.

Responsibility. Financial and project responsibilities are defined in an MOU between DND and other government departments (OGD). Following project approval, DRDC advances funds to the lead federal department for each CRTI project. An interdepartmental settlement mechanism is used to transfer CRTI monies to the lead federal department. The lead department establishes an OGD suspense account. When DND is the lead, the transfer of funds is done via internal processes. CRTI funds advanced to other federal departments can be applied against incremental costs in direct support of the project, and/or used to contract with the private sector and/or academia, as established in the project plan. Incremental costs may include capital costs, salaries and benefits for Public Service employees, project management, and operations and maintenance costs. Departments are able to retain capital items procured using CRTI funds, subject to an asset transfer from DND in the year the item was procured. CRTI AP projects have a separate process for the transfer of funds using Supplementary Estimates.



All departments are responsible for the funds received for CRTI projects and must adhere to their own departmental expenditure authorities, in addition to keeping separate accounting records for each CRTI project. PSAT funding that has been transferred to OGDs, but not used during the FY, is returned to DND at year-end. DND is obliged to carry forward the unused PSAT funding at end-year which impacts DND’s ability to carry forward other departmental funds. However, the CSS Financial Officer can only ensure effective financial management and minimize the year-end carry-over of unused PSAT funding if he or she receives accurate financial reporting from the Project Managers.

Finding

- Effective financial management to minimize the year-end carry over of unused PSAT funding is dependent upon accurate financial quarterly reporting.

Recommendation

9. Develop mechanisms for the Project Managers of CRTI projects to provide accurate and timely quarterly reporting of financial information.

OPI: ADM(S&T)

In-Kind Contributions. The four categories of CRTI projects are funded within a “leveraged program” model. To promote shared responsibilities and ensure a high level of commitment, participants in the funded activities must contribute in-kind contributions to the project at a minimum of 33 percent of the total project cost. The CRTI investment in projects will not exceed 67 percent of the total project cost. The leveraged funding by project category is shown in Table 4:

CRTI Funding Period FY 2007/08 – FY 2011/12 Project Categories	CRTI Funds	In-Kind Funds	Total
RD	\$59,427,749	\$59,508,986	\$118,936,735
TD	\$46,365,619	\$38,502,969	\$84,868,688
TA	\$25,759,086	\$26,040,608	\$51,799,964
AP	\$28,585,387	\$15,317,729	\$43,902,116
Totals	\$160,137,841	\$139,370,292	\$299,507,503

Table 4. CRTI Funding and In-Kind Funds by Project Category. This table lists the amount of CRTI funding and in-kind funding for the RD, TD, TA and AP project categories.

In-kind contributions include cash (i.e., matching funds) and other. The non-cash contributions are normally given a cash value and may include direct labour costs (employee time plus benefits), direct material costs, indirect overhead costs, and use of equipment/facilities. Leveraging of international programs may be considered as in-kind contributions, provided the leverage is quantified in a MOU or Project Arrangement, and applies to the specific time period of the project.

The in-kind contribution can be spread over a number of years within a CRTI project, and generally comprises salary costs for personnel working directly on the project (plus an employee overhead factor) and/or the costs of operating facilities accessed by the project. Overhead factors are determined in a manner consistent with the policies of PWGSC. Universities that participate in CRTI projects receive funds, based on specific deliverables, via a contracting process. The contracts for external partners are written by PWGSC.

During the current funding period, in-kind contributions totaled more than 44 percent of total project costs (or 11 percent more than the prescribed minimum level). This subsequently permitted CRTI funds to be allocated towards additional projects and activities.

Finding

- The CRTI demonstrated “economy of program.” CRTI costs to undertake activities to create outputs in support of outcomes was less than 67 percent of the total project costs during the current funding period.

CSS Overhead Expenses. As the CSS was established during the current funding period by a MOU with PS, its common services/overhead are funded from each of the CRTI, Pstp and CPRC programs. Accordingly, the Secretariat functions for the three programs administered by DRDC CSS have now been harmonized.

The percentage breakdown between programs is not pre-determined and is flexible, based on available funds and ongoing project funding pressures. A formula is applied annually to balance operating costs between the three programs which allows for increased efficiency and reduction in duplication of effort. Non-administrative disbursements are controlled separately for each program.

As shown at Table 5, the ratio of operating costs to the S&T investment budget is 8.95 percent. This is below the referenced 15-percent benchmarking ratio (administrative costs versus total investment budget),⁴¹ used to assess the cost-efficiency of such programs. This percentage of operating costs to total costs is slightly less than the 9.19 percent calculated for the previous funding period.⁴²

⁴¹ CRTI Summative Evaluation (2008).

⁴² Ibid.

Funding Categories	Expenditures FY 2007/08 to FY 2011/12
Operating Costs	
Salaries and Benefits	\$5,013,925
Administrative Costs	\$11,052,704
Sub-total (A)	\$16,066,629
Non-administrative Disbursements	
S&T Investments (Vote 1)	\$125,814,352
S&T Investments (Vote 5)	\$37,631,335
Sub-Total (B)	\$163,445,687
Total Costs (A+B)	\$179,512,317
Ratio of Operating Costs (A) versus Total Costs	8.95 %

Table 5. Ratio of CRTI Operating Costs versus Total Costs. This table lists operating costs and non-administrative disbursements (includes projected costs for FY 2011/12).

Note Concerning the Discrepancy in Total CRTI Costs: (Table 4 versus Table 5):

Discrepancies in CRTI totals of \$160 million in Table 4 versus \$179 million in Table 5 are a result of the databases accessed. The total in Table 4 derives from a project database used for planning potential expenditures, to notional levels. Figures in Table 5 are from an “Actuals” database, but include a forecast element. The CSS operates with an expenditure forecast higher than it expects the projects to cost. The TB allocated total funding of \$175 million is \$4 million less than shown in Table 5 (\$179 million). Hence the CSS has forecasted to overspend during this current funding period (historically between \$4 million and \$10 million) in the realization that many projects underspend their annual allocations. For Table 5, the figures for FY 2011/12 were provided in spring 2011 and would represent forecasts for FY 2011/12. Based on available financial information, the CSS has forecasted \$4 million as a reasonable amount for estimating how much may be unspent by the projects by the end of FY 2011/12.

Finding

- Given the ratio of operating costs versus S&T investment expenditures, the CRTI is assessed to be operating efficiently.

Organizational Alternatives

The 2006 MOU between PS and DND promotes mutual collaboration in the development and application of S&T to enhance public safety and security. The provision of Public Security S&T services to PS, through the CSS, enables PS to benefit from the established S&T expertise of DRDC. Some alternatives to the present construct to create further efficiencies might include the following:

- creating a stand-alone Public Security S&T capability to coordinate CRTI and other public safety and security-related S&T programs;

- merging with Granting Council academic research programs to meet the requirements for CRTI and other public safety and security-related S&T programs; or
- merging the CRTI, Pstp and CPRC into a single harmonized program.

Creating a Stand-Alone Public Security S&T Capability. PS is the mandated lead department for public safety and security coordination. As an alternative to the present construct, PS could establish its own internal mechanisms for coordinating S&T via an in-house capacity to acquire, manage and coordinate scientific activity. Unbiased scientific advice could be acquired either internally or through service procurement mechanisms. This alternative has the advantage of co-locating an S&T capacity under the lead department responsible for the government's public security agenda; however, it would necessitate that PS develop an independent S&T management capability that risks duplication of, and competition for, limited human resources required to develop and maintain a cadre of S&T managers.

It would be difficult for PS to create the level of national and international linkages already established by DRDC, and could potentially impair the close relationship between defence and security S&T that has been facilitated under DRDC. As this alternative would duplicate capabilities already extant in DRDC, it is assessed as neither a practical nor cost-effective alternative for the GoC.

Merging with Granting Council Academic Research Programs. Canadian Granting Councils, such as the Canadian Social Sciences and Humanities Research Council and the Natural Sciences and Engineering Research Council of Canada, fund some research on aspects of public safety and security but operate under a different model. Potentially, Granting Councils might establish specific programs to fund additional academic research into public security S&T. The difference between grants offered by the Granting Councils and PSTP/CRTI investments is that PSTP/CRTI investments are essentially contracts to deliver end-results within a set period of time and which, depending on the type of project, will deliver an end-product into the hands of end-users.

In addition, the integrated risk and capability-based approach used by all programs funded through PSTP (CRTI, Pstp and CPRC) underpins investment prioritization which can provide a coherent, comprehensive approach and allows for GoC strategic and policy oversight. The TA and TD aspects of the CRTI provide the agility to respond to immediate and pressing issues and are atypical to Granting Council programs.

This alternative might further leverage ongoing academic research in areas of Public Security S&T; however, it would not advance CSS progress to operationalize research and technology for the safety and security of Canadians. This is not considered a viable option for the GoC.

Merging the CRTI, Pstp and CPRC into a Single Harmonized Program. The CRTI funding renewal document approved for the start of the current funding period prescribed that the governance of the CRTI and Pstp would be harmonized. Under the present CSS governance construct, the three PSTP programs of CRTI, Pstp and CPRC remain individually funded and administered as separate entities. This alternative considers that

CSS would further harmonize the strategic direction, operational processes and administrative requirements of the three PSTP programs into a single program. This would further exploit the capability-based planning and consolidated risk assessment processes within a consolidated program, and would necessitate harmonizing the mandates and outcomes of the CRTI, Pstp and CPRC programs under a revised governance structure.

This new construct could (1) provide an “all hazards” approach to public safety and security priorities; (2) if appropriately administered, should avoid duplication of effort that currently exists across the three programs, such as with the Call for Proposals process; and (3) allow for a re-allocation of resources to address PSTP investment priorities and facilitate increased efficiencies.

Finding

- The PSTP governance construct and management processes remain in transition since the creation of the CSS. It is assessed that further harmonizing of the three PSTP programs will facilitate increased efficiencies.

Recommendation

10. Harmonize the three PSTP programs to increase program efficiency.

OPI: ADM(S&T)



Summary of Findings and Recommendations

Finding

- The CRTI contributes to the safety and security of Canadians. The CRTI meets a continuing need to improve Canada's CBRNE response capabilities through a shared, whole-of-government approach to the operational delivery of S&T.

Finding

- The CRTI aligns with federal government strategies, priorities and departmental strategic objectives.

Finding

- The CRTI aligns with, and directly supports, the roles and responsibilities of the federal government.

Finding

- CRTI projects and science cluster activities (such as workshops, exercises and training) are effectively building S&T capacity to address all-hazards risks.

Finding

- CRTI is providing the S&T and operational communities with enhanced capabilities and knowledge in critical areas that increase Canada's preparedness for a wide range of risks.

Finding

- CRTI funding is building the capacity of science clusters through acquisitions and a wide range of knowledge-sharing activities.

Finding

- CRTI investments have developed, and continue to develop, technologies that directly support responder communities and operational authorities.

Finding

- S&T investments were deployed effectively to support the security of major international events hosted in Canada and to assist the GoC response to a nuclear crisis in Japan. In this funding period, CRTI directly supported the successful development and operationalizing of S&T investments which contributed significantly to the safety and security of Canadians.

Finding

- The CSS informs the public and stakeholders of CRTI activities and supports knowledge sharing across the policy, S&T, and responder communities. More extensive use of the Internet and Intranet could provide additional opportunities, which have not yet been exploited by the CSS, for knowledge sharing and decision making.

Recommendation

1. Promote more extensive use the Internet and Intranet, within security constraints, to disseminate information about CRTI projects and activities. Initiatives that could be implemented may include searchable databases of CRTI investments and links to the outputs and outcomes of funded projects.

OPI: ADM(S&T)

Finding

- The design of CSS communications products reflects a DRDC focus, whereas CSS Public Security S&T projects and activities are pan-departmental.

Recommendation

2. Design CSS communications products (including logos/headers) to reflect its pan-departmental public safety and security focus.

OPI: ADM(S&T)

Finding

- The PSST SC has not been effective with the present governance construct. The intent of the PSST SC to promulgate top-down direction in the form of a strategic guidance document has not been realized. The anticipated advisory board, as described in the 2008 interdepartmental MOU, has not been established.

Recommendation

3. Develop and implement an effective and administratively supportable governance construct.

OPI: ADM(S&T)

Finding

- The CSS lacks a single comprehensive and cohesive framework document which explains the organization's provision of services in support of Public Security S&T.

Recommendation

4. Establish a CSS framework document as an overarching foundational document for other amplifying CSS documents and instructions, with a regular multi-year review cycle to ensure its continued applicability.

OPI: ADM(S&T)

Finding

- There is a lack of consistency in the use of acronyms, nomenclature and descriptions throughout the CSS and CRTI documentation.

Recommendation

5. Ensure key publications, guides and Internet and/or Intranet sources of information, which are fundamental to understanding the Program and its organization and processes, are current and that the terminology is consistent.

OPI: ADM(S&T)

Finding

- The potential for a disjointed approach to medical issues exists within the present cluster construct.

Recommendation

6. Establish a coordinated S&T approach to medical issues; consider the development of a Medical Cluster.

OPI: ADM(S&T)

Findings

- The CRTI Investment Priority process focuses S&T projects to meet the security and public safety needs of Canadians.
- CRTI project selection is conducted through a comprehensive and transparent, yet very time-consuming process which meets PWGSC requirements. The CSS has also encountered procedural delays due to process requirements and PWGSC staff changes.

Recommendation

7. Develop options that meet CSS contracting requirements and mitigate delays in the contract processes.

OPI: ADM(S&T)

Findings

- To monitor efficiency, CRTI has established regular and reliable quarterly progress reporting for each CRTI project and activity. The quarterly reports monitor and track technical milestones, timelines, costs and risks. Costs can be associated with each output.
- Neither the CSS, nor the CRTI as the funded program, have developed a Performance Measurement Strategy which outlines all performance measurement responsibilities, procedures and authorities for the Program.

Recommendation

8. Develop a consolidated Performance Measurement Strategy and Performance Measurement process, in accordance with the TBS Guide “Supporting Effective Evaluations: a Guide to Developing Performance Measurement Strategies,” for the CSS-led Public Security S&T Program, which includes the CRTI.

OPI: ADM(S&T)

Finding

- Effective financial management to minimize the year-end carry-over of unused PSAT funding is dependent upon accurate financial quarterly reporting.

Recommendation

9. Develop mechanisms for the Project Managers of CRTI projects to provide accurate and timely quarterly reporting of financial information.

OPI: ADM(S&T)

Finding

- The CRTI demonstrated “economy of program.” CRTI costs to undertake activities to create outputs in support of outcomes was less than 67 percent of the total project costs during the current funding period.

Finding

- Given the ratio of operating costs versus S&T investment expenditures, the CRTI is assessed to be operating efficiently.

Finding

- The PSTP governance construct and management processes remain in transition since the creation of the CSS. It is assessed that further harmonizing of the three PSTP programs will facilitate increased efficiencies.

Recommendation

10. Harmonize the three PSTP programs to increase program efficiency.

OPI: ADM(S&T)

Annex A—Management Action Plan

CRTI Communications and the Dissemination of Knowledge

CRS Recommendation

1. Promote more extensive use of the Internet and Intranet, within security constraints, to disseminate information about CRTI projects and activities. Initiatives that could be implemented may include searchable databases of CRTI investments and links to the outputs and outcomes of funded projects.

Management Action

A comprehensive project is under way using Microsoft SharePoint 2010 as a framework to develop a series of applications to enhance program-generated information and knowledge search and dissemination. The recommendation will be implemented in collaboration with DRDC Corporate Services, which are responsible for corporate communications and information technology policy.

OPI: ADM(S&T)

Target Date: September 2012

CRS Recommendation

2. Design CSS communications products (including logos/headers), to reflect its pan-departmental public safety and security focus.

Management Action

DRDC CSS will develop, through agreement with DRDC and PS, an appropriate communications strategy including branding reflective of the program's public safety and security objectives and stakeholders while at the same time still identifying CSS as part of DRDC.

OPI: ADM(S&T)

Target Date: September 2012



Governance

CRS Recommendation

3. Develop and implement an effective and administratively supportable governance construct.

Management Action

The governance construct for the harmonized program and DRDC CSS will be clarified and streamlined to ensure rapid information dissemination, provision of guidance and timely decision making. To the extent possible it will encompass key public safety and security stakeholders from the policy, operations, intelligence and science communities.

OPI: ADM(S&T)

Target Date: September 2012

CRS Recommendation

4. Establish a CSS framework document as an overarching foundational document for other amplifying CSS documents and instructions, with a regular multi-year review cycle to ensure its continued applicability.

Management Action

A public safety and security S&T program framework document will be defined covering the program authorities, strategic foundation, operating principles, governance and strategic planning decision cycles, outcomes and performance/risk framework, etc. as well as a set of enabling documents (MOU, etc.).

OPI: ADM(S&T)

Target Date: September 2012

CRS Recommendation

5. Ensure key publication, guides and Internet and/or Intranet sources of information, which are fundamental to understanding the Program and its organization and processes are current and that the terminology is consistent.

Management Action

In concert with management activities under recommendations 1, 2 and 4, the information sets required by internal and external stakeholders are being updated to ensure accuracy and consistency. This suite of program documents will be reviewed and updated on a regular basis.

OPI: ADM(S&T)

Target Date: September 2012

CRS Recommendation

6. Consider a coordinated S&T approach to medical issues, perhaps through the development of a Medical Cluster.

Management Action

A series of profession-based communities has been stood up over the past several years. The health profession group comprising emergency medicine practitioners (i.e., first receivers) as well as psycho-social experts has recently been formed. The intent will be to form this group into a stand-alone community of practice.

OPI: ADM(S&T)

Target Date: May 2012

CRTI Project Selection

CRS Recommendation

7. Develop options that meet CSS contracting requirements and mitigate delays in the contract processes.

Management Action

DRDC CSS, together with PWGSC, has made significant progress in this area. A PWGSC team leader currently works on-site weekly; as well, a new practice has been instituted where a PWGSC contracting officer is assigned as soon as the Charter is developed. These measures will be reviewed on a regular basis to ensure continued efficiency and to modify as required.

OPI: ADM(S&T)

Target Date: Completed. (September 2011)

CRTI Performance Measurement

CRS Recommendation

8. Develop a consolidated Performance Measurement Strategy and Performance Measurement process, in accordance with the TBS Guide “Supporting Effective Evaluations: a Guide to Developing Performance Measurement Strategies,” for the CSS-led Public Security S&T Program, which includes the CRTI.

Management Action

DRDC CSS, through its governance, will develop a safety and security S&T outcome suite and logic map that identify both performance metrics for its immediate, intermediate and long-term outcomes and associated programmatic risks. Responsibility for defining these and ensuring performance data are collected and analyzed will be assigned to a DRDC CSS executive.

OPI: ADM(S&T)

Target Date: September 2012

CRTI Financial Management

CRS Recommendation

9. Develop mechanisms for the Project Managers of CRTI projects to provide accurate and timely quarterly reporting of financial information.

Management Action

As indicated in the Management Action for Recommendation 1, the SharePoint 2010 project will establish a program management application that will enable timelier reporting. Within that framework, an application is being developed that will improve the utility of the quarterly reporting processes for project managers and tracking tools for DRDC CSS. An annual workshop for Project Managers and Finance Managers from other government departments will ensure that requirements and obligations for quarterly and year-end reporting are understood. Ongoing bi-annual reviews of all projects will provide an opportunity to address reporting issues.

OPI: ADM(S&T)

Target Date: June 2012

Organizational Alternatives

CRS Recommendation

10. Harmonize the three PSTP programs to increase program efficiency.

Management Action

DRDC CSS and PS are seeking government approval for a harmonized approach to public safety and security S&T that is responsive to government priorities and managed by outcomes.

OPI: ADM(S&T)

Target Date: September 2012



Annex B—Public Security S&T Logic Model

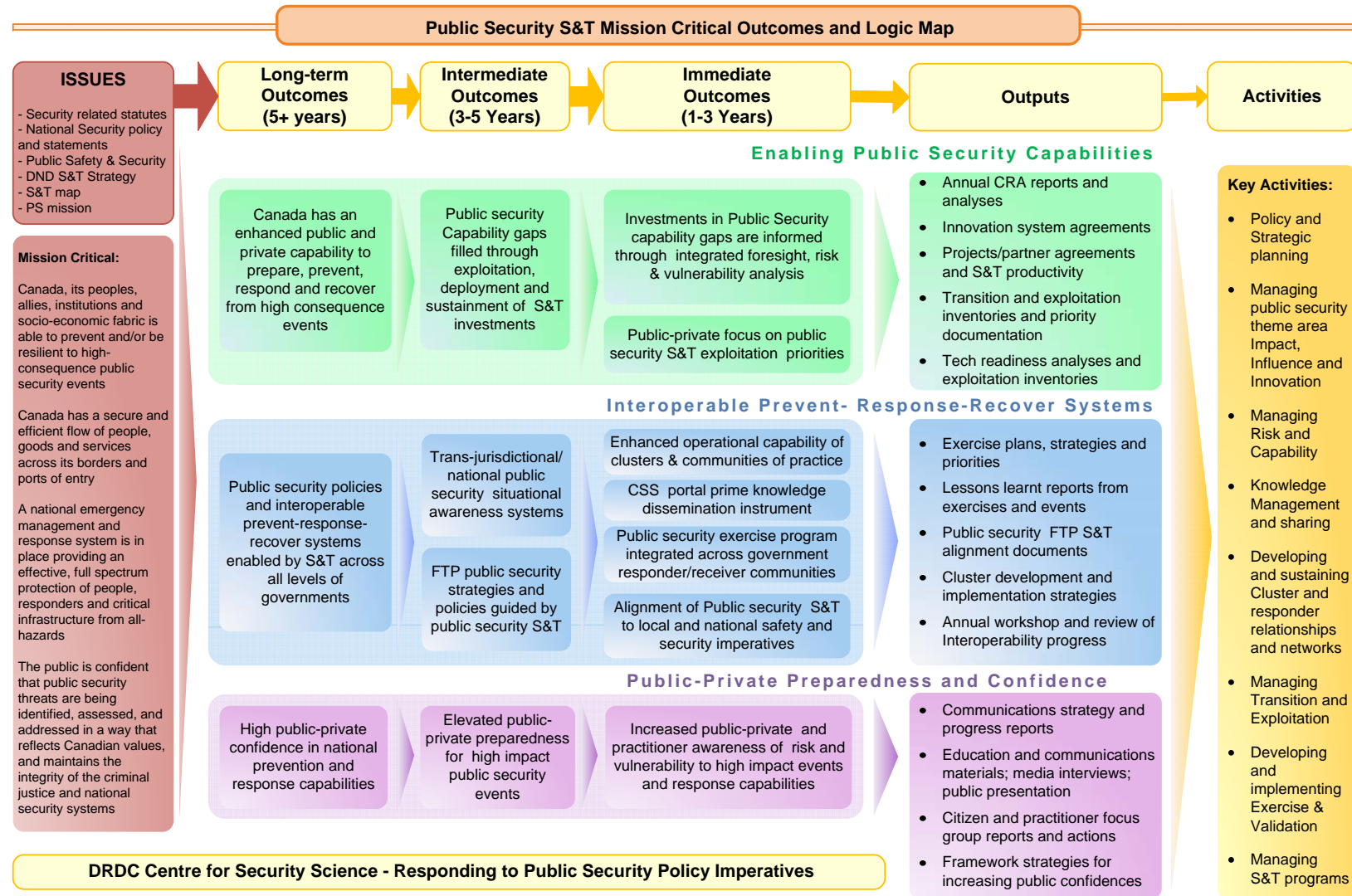


Figure 5. Public Security S&T Logic Model. This Public Security S&T activities are linked to outputs and outcomes in the three streams of Enabling Public Security Capabilities, Interoperable Prevent-Response-Recover Systems, and Public-Private Preparedness and Confidence.

Annex C—CRTI Science Clusters

Chemical Cluster

Participating Federal Departments and Agencies	
Agriculture and Agri-food Canada (AAFC)	HC
CBSA	National Research Council (NRC)
CFIA	NRCan
DRDC Suffield	RCMP
Department of Fisheries and Oceans	Royal Military College
EC	

The CRTI’s Chemical Cluster focuses on the needs of laboratories and the operational community to find ways to address potential chemical emergencies. This includes improving analytical approaches to the detection of chemical threats and hoaxes; identifying lead laboratories for all chemicals on the priority substances list and addressing gaps in capabilities for analyzing chemicals; improving integration of data and information management systems for operational needs; developing improved capabilities for field detection of chemicals; and improving mobile analytical capabilities to provide direct support to responders.

Biological Cluster

Participating Federal Departments and Agencies	
AAFC	NRC
CBSA	NRCan
CFIA	PHAC
CSIS	PS
DRDC Suffield	RCMP
EC	TC
HC	

CRTI’s Biological Cluster focuses on providing S&T advice and developing capabilities to strengthen Canada’s preparedness for biological threats. Biological threats can take many forms and can arise from accidental or malicious scenarios, including natural disease outbreaks (i.e., SARS and H1N1), accidental spread of microbes from international travelers and potential bioterrorist attacks (i.e., anthrax, Ebola or other diseases). Unique to this type of threat, diseases can spread undetected while in their incubation period. To further complicate the problem, bacteria and viruses can mutate while responders try to identify and contain the disease.

The Biological Cluster provides S&T advice and capabilities for the protection and security of Canadians against bioterrorist threats. Its projects include developing clean-up standards for building decontamination after a biological attack, building a device that can detect and classify bio-aerosols from laser induced fluorescence, assessing the vulnerabilities of Canada’s food supply to mitigate threats, and constructing Canada’s all-hazards sample receiving and storage facility to handle substances of unknown composition.

Radiological-Nuclear Cluster

Participating Federal Departments and Agencies	
Atomic Energy of Canada Ltd.	HC
CBSA	NRC
Canadian Nuclear Safety Commission	NRCan
DND	PS
DRDC	RCMP
EC	TC

CRTI’s RN Cluster focuses on the needs of laboratories and the operational community to address potential RN emergencies. The proliferation of nuclear weapons or radiological dispersal devices available to terrorist groups poses a threat to Canada’s national security. The impact of an intentional nuclear detonation could result in an unprecedented number of casualties, while a radiological dispersal attack could cause significant economic and social disruption in an urban environment.

Goals of the RN Cluster include improving capabilities for early detection, location and identification of challenging agents, including special nuclear materials; developing methodologies, tools and networks to minimize the impacts of a radiological event; and enhancing forensic capabilities in conjunction with law enforcement organizations.

Explosives Cluster

Participating Federal Departments and Agencies	
CBSA	Laboratoire des Sciences Judiciaire de Montréal
Canadian Explosives Technician Association	NRCan
Centre of Forensic Sciences (Toronto)	Ontario Provincial Police
DND	PWGSC
DRDC Suffield	RCMP
DRDC Valcartier	Sûreté du Québec
NRC	TC

Annex C

CRTI’s Explosives Cluster focuses on scenarios where explosives are the threat agent and where explosives are used as a dispersal device for CBRN agents. Goals include addressing critical gaps in fundamental science detection technology and developing integrated and interoperable solutions to effectively respond to attacks involving explosives. Projects include a database of scientifically validated information on improved explosive mixtures, assessment of detection technologies, designing lightweight composite armour for protection against improvised explosive devices, developing new methods of neutralizing improvised explosive devices, developing new methods of stand-off explosives threat detection, and developing modelling tools and protocols to assess the effects of explosive threats in urban environments.

Forensics Cluster

Participating Federal Departments, Agencies and other organizations	
Calgary Police	Ottawa Police
Centre of Forensic Sciences (Toronto)	PHAC
DRDC Canada	PS
Edmonton Police Services	Regina Police
Fredericton Police	Royal Newfoundland Constabulary
Halifax Police	Saint John Police
Health Canada	Saskatoon Police
Laboratoire des sciences judiciaires et de médecine légale	Toronto Police Service
Montreal Police Department	Sûreté du Québec
West Vancouver Police Services	Vancouver Police Department
Ontario Provincial Police	Winnipeg Police

CRTI’s Forensics Cluster activities span the other CRTI clusters as there are CBRNE elements within forensics. This Cluster addresses challenges common to all clusters by leveraging its working relationship with emergency managers, first responders and other end-users of CBRNE technologies and works to promote interoperability among responder and operational communities.

Cluster priorities include providing “crime-scene to court-room” support to other science clusters, including training, preservation of materials, development of analytical protocols and presentation of scientific evidence in court; developing comprehensive partnerships with COPs from forensic laboratories, CBRNE S&T performers and forensic identification specialists; and facilitating strategic international collaborations in CBRNE forensics.

Cluster projects include integrating forensic expertise into operational and emergency plans, conducting studies and experiments to define level and duration of CBRNE response capabilities across the response spectrum, and developing protocols for examining contaminated evidence.

Psychosocial Cluster

Participating Federal Departments, Agencies and Other Organizations	
DND DRDC	York University
PS	Ontario Medical Association
RCMP	Mount Sinai Hospital
PHAC	Justice Institute of British Columbia
CFIA	Salvation Army
University of Ottawa	GAP Santé
University of Waterloo	TAIBU Community Health Center
McMaster University	

The Psychosocial Cluster looks at improving preparedness to cope with the short-term, mid-term, and long-term responses to CBRN threats or attacks. The behavioural and psychological impacts of CBRN terrorism may be the most widespread, long-lasting, and costly consequences of an event. Because every response to a CBRN terrorist event is unique, training of all key responders on psychosocial considerations is crucial to managing the acute and long-term effects of CBRN terrorism. Tools to enhance the capability of key responders in Canada and to mitigate the psychosocial impacts of CBRN threats and attacks are a priority of this cluster.

Annex D—Technology Readiness Levels

Broad Terminology	TRL	Description	Level of Risk Tolerance	Relative Cost
Basic Research	1	Basic principals observed and reported.	Highest	Lowest
	2	Technology concept or application formulated through analytical studies.	High	Low
Applied Research / Research to Prove Feasibility	3	Analytical and experimental critical function or characteristic proof of concept.	Medium-High	Medium-Low
	4	Concept, process, component, or subsystem validation in a relevant environment.	Medium-High	Medium-Low
Experimental or Technology Development	5	Concept, process, component or subsystem validation in a laboratory environment.	Medium	Medium
Demonstration and Validation / Engineering Feasibility	6	Concept, process, system/sub-system model or prototype demonstration in a relevant, high-fidelity environment	Medium-Low	Medium-High
	7	Concept, process or system prototype demonstration in an operational environment.	Medium-Low	Medium-High
Engineering and Manufacturing Development	8	Actual concept, process, or system completed and qualified through test and demonstration.	Low	High
System Test and Operations / Operational Systems Development	9	Actual concept, process, or system proven through successful mission operations (operational test and evaluation).	Lowest	Highest

Table 6. Determination of CRTI Project Categories Based on Technology Readiness Levels (TRL).⁴³
 This table provides broad definitions and descriptions for TRLs 1 to 9.

⁴³ CRTI – Call for Proposals Bidder Guidebook for Call 9 (page 12).

Annex E—CRTI Project Categories

Research and Technology Development

Description. RD projects are highly innovative and can generate new S&T capabilities in areas critical to CRTI. The projects are often high risk, but have the potential to provide high payback and significant impact to S&T end-users. Projects will frequently be collaborations led by federal partners involving academia, government laboratories and industry to advance technologies and discoveries from earlier TRL (TRL 1 or 2) into Applied R&D (TRL 3 to 5). The intent of the RD category is to ensure that successful projects are transitioned into higher TRL areas and then proceed to operational use. Input from the end-user community is a key component to RD project formulation.

Objective. To generate knowledge, address user-defined capability gaps, and develop technologies and S&T capabilities in critical areas relevant to CRTI investment priorities.

Technology Demonstration

Description. TD projects transition S&T and early-stage development systems into system-level prototypes that can be used in an operational setting to demonstrate impact and utility. Demonstrations can take place in realistic settings or exercises to test and validate new technologies, S&T tools and concepts in command and control operations. Demonstrations will often identify deficiencies and uncover gaps in capabilities. The expected maturity of a TD project “leave-behind” capability is TRL 6 to 7.

Objective. To advance the maturity of a technology or capability from TRL 4 or 5 to TRL 6 or 7 and demonstrate to S&T end-users the value of the technology to address operational requirements and to close capability gaps. TD projects are not intended to market products to a customer, be a sales activity or conduct test and evaluation on a commercial product.

Technology Acceleration

Description. TA projects complete the development of a technology or modify an existing technology to enable a new application and transition it to in-service use. The TA project will accelerate the commercialization and transition of new technologies at the TRL 6 or 7 levels towards a mature product or capability that can be adopted by S&T end-users in no more that two years from project initiation. There must be either a well-defined market or the opportunity to develop a major new market for the product or capability.

Objective. To accelerate the commercialization and transition to S&T end-users of products or capabilities that have already been demonstrated in operational environments (TRL 6 or 7) but have not yet been fully qualified and deployed in operational systems (TRL 8+).



Technology Acquisition

Description. AP projects investments, which are separate from CRTI-funded projects through the Call for Proposals process, fund specific capacities within the science clusters. These investments take the form of workshops, exercises, studies and acquisitions which identify or address gaps in cluster capacity. Potential AP projects are identified and ranked in order of priority by each cluster in their Business Plans to ensure the projects respond to the highest priority capability gaps.



Annex F—Synopses of Five CRTI Projects Supporting CRTI Activity 2

Example 1

Project	Development of Standards for Decontamination of Buildings and Structures Affected by Chemical or Biological Terrorism
Designation	CRTI 04-0018RD (Research and Technology Development)
Completion Date	31 March 2009
Lead Department	EC
Cost	CRTI \$2,710,000 and in-kind \$2,822,224
Partners	PHAC, SAIC Canada, DRDC Suffield, US Environmental Protection Agency, University of Ottawa, University of Leeds, Russian Research Institute of Hygiene, Toxicology and Occupational Pathology.
Objective	The development of clean-up standards for the decontamination of a building after a chemical or biological attack.
Relevance	Decontamination of facilities following acts of Chemical or Biological terrorism is designed to mitigate hazards to the extent that facilities can be re-commissioned to their former use.
Progress/Results	Clean-up standards for agents that represent a real or potential risk have been developed. This information enables the estimation of clean-up costs to determine whether a facility should be decontaminated and restored, or demolished and rebuilt.
Impact	The methodologies used in the experimental and modeling work can be developed into standards for additional compounds, enabling their use by first responders to top-level decision makers.

Example 2

Project	Development of a Canadian Standard for Protection of First Responders from CBRN Events
Designation	CRTI 05-0016RD (Research and Technology Development)
Completion Date	31 March 2011
Lead Department	PWGSC
Cost	CRTI \$549,978 and in-kind \$646,800
Partners	PSC, TC, RMC, RCMP, National Research Council (NRC), Canadian Standards Association, Canadian Association of Fire Chiefs, Canadian Council of Health Services Accreditation, Canadian Professional Police Association, PHAC, International Association of Firefighters (Canadian Office), and the Paramedic Association of Canada.
Objective	The development of the first national standard of requirements for protective CBRN equipment used by first responders.
Relevance	The new standard addresses protection against multiple CBRN risks faced by first responders. The standard improves the harmonization of all-hazards protective equipment used by Canadian first responders, and enhances consequence management capabilities.
Progress/Results	In October 2010, the National Standards Council of Canada ratified the standards. A federal government announcement was made on 25 January 2011.
Impact	This ratified standard provides first responders with information to ensure that the appropriate suite of protective equipment and systems is selected and used during CBRN incidents. The project involved stakeholders with world-class expertise in protective equipment development and evaluation for CBRN agents. The new standard supports the needs of all levels of government, industry, and first responders directly.

Example 3

Project	Portable Biological Agent Detection System
Designation	CRTI 06-0187TD (Technology Demonstration)
Completion Date	31 March 2011
Lead Department	NRC
Cost	CRTI \$2,500,000 and in-kind \$3,901,292
Partners	RCMP, DRDC Suffield, Université Laval, and the Centre Hospitalier Universitaire de Québec.
Objective	To develop a portable instrument for the rapid and reliable molecular detection of biological agents.

Annex F

Project	Portable Biological Agent Detection System
Relevance	This project is relevant to many CRTI priority areas. It provides investigative authorities such as RCMP a tool to diagnose, track, and detect the source of biological agents (e.g., anthrax). The instrument could also support the first responders in determining the existence and scale of a CBRNE event and in quickly screening CBRNE exposed individuals.
Progress/Results	A final demonstration is planned for fall 2011.
Impact	This project improves Canada's response and ability to contain and manage the consequences of biological terrorism.

Example 4

Project	Portable Electronic Microarrays for Agro-bioterrorism: Detection and Typing of High-Consequence Agents
Designation	CRTI 07-0132TA (Technology Acceleration)
Completion Date	31 March 2011
Lead Department	CFIA
Cost	CRTI \$1,375,675 and in-kind \$1,075,356
Partners	Nexogen, Inc. and the UK Institute for Animal Health.
Objective	To provide assays for bovine and avian high-consequence agents in an automated, portable, integrated instrument.
Relevance	To address a need for investigative capabilities by providing strain identification of high-consequence agents for forensic analysis. The ability to quickly identify multiple strains during a terrorist attack supports quicker criminal investigation.
Progress/Results	Ongoing. Start date was January 2009. Three assays have been developed for bovine, avian and foot and mouth disease.
Impact	High-consequence livestock pathogens are suited for bio-terrorism because of their devastating effects. In case of a suspected outbreak, there is an urgent need for rapid on-farm testing by first responders and veterinarians.

Example 5

Project	CBRN Crime Scene Modeler (C2SM)-Fast
Designation	CRTI 07-0216TA (Technology Acceleration)
Completion Date	31 March 2011
Lead Department	RCMP
Cost	CRTI \$2,095,660 and in-kind \$1,377,185
Partners	CPRC, DRDC Ottawa, MDA Space Missions, Hamilton Police Services, Toronto Police Services, Vancouver Police Department, and York University.
Objective	To develop technologies for investigating crime scenes contaminated with CBRNE materials using unmanned robots, and to build and deploy multiple prototypes with first responders.
Relevance	<p>Currently, first responders investigating CBRNE contaminated scenes rely on tele-operated robots to deliver cameras and detectors. Situational awareness is low because existing systems are equipped only with video cameras and simple CBRNE detectors. Measurements from sensors are not registered with the workspace, robot location, or camera views and detector data may not be available in real time.</p> <p>C2SM is a self-contained system with sensor and detector suites that operates on-board a tele-operated robotic platform. It offers a solution for detecting and locating CBRNE sources, mapping contamination levels and managing consequences.</p>
Progress/Results	Started in June 2009. A prototype is in the testing and evaluation phases.
Impact	<p>C2SM will reduce first responder exposure to CBRNE agents and enable the investigation of contaminated crime scenes from a distance.</p> <p>C2SM will increase responders' situational awareness with an integrated 3-D view of event data, and a 2-D map of the robot location.</p>

Annex G—Synopsis of three CRTI Projects Supporting CRTI Activity 3

Example 1

Rapid Sequencing Capability in the Field for Confirmation of Identification (BIO-056 AP)

Led by PHAC's National Microbiology Laboratory in Winnipeg, this project led to the procurement of technology for the detection of bioterrorism agents using bacterial or viral DNA/RNA in the field. In order to respond to a bioterrorism event, microorganism detection must be rapid, precise, sensitive and reliable. As an add-on to the Mobile Biological Laboratories deployed to Vancouver and Whistler during the Olympics, this acquisition enhanced the safety and security of Canadians, visitors and athletes. Suspicious samples collected by the RCMP field response teams were tested routinely in the mobile laboratories, with the rapid sequencing provided through this project as a confirmatory test.

This project has increased the capacity of PHAC to rapidly sequence positive samples through world-class technology, and eliminated time that would have been used to send samples to the National Microbiology Laboratory.

The quick confirmation of a bioterrorism agent impacts incident management and is integral to maintaining public confidence. Following the Vancouver 2010 Olympic Games, this mobile equipment was integrated into operations at the National Microbiology Laboratory and is positioned for future deployment.

Example 2

Solid State Laser Ablation System (EX-007AP)

Acquired by CSIS through the Explosives and Forensics Clusters, this system provides a tool that can be exploited by forensic, biological and materials science laboratories. The project provides CSIS with a capability to populate a chemical profile database, crucial to CBRNE investigations. This data can then be shared with the RCMP, CBSA and DND.

Example 3

Fixed Point Surveillance Network (RN-047AP, RN-080AP and RN-081AP)

The RCMP, through the *ad-hoc* Federal Radiological Assessment Team, requested expertise to detect radioactive materials at security checkpoints during the Vancouver 2010 Olympic Games. This fixed-point surveillance system, interoperable with a national fixed-point network that measures emissions at Canadian nuclear facilities, allowed screening personnel at the Olympics to provide data to the S&T community for the identification of dangerous isotopes. The detectors were seamlessly integrated into the CRTI-funded ARGOS and are positioned to be absorbed into the existing monitoring system to further leverage this investment in S&T cluster capacity.

Annex H—DRDC CSS Programs Stakeholder Feedback Questionnaire 2011

DRDC CSS PROGRAMS STAKEHOLDER FEEDBACK 2011

Question	Rating scale (questions 2-12 & 20 scale: 1-5)										
1. Please indicate what type of organization you represent:	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%;"></td> <td style="width: 20%;"></td> <td style="width: 20%;"></td> <td style="width: 20%;"></td> <td style="width: 20%;"></td> </tr> <tr> <td style="text-align: center;">Industry</td> <td style="text-align: center;">Uni</td> <td style="text-align: center;">Fed Gov</td> <td style="text-align: center;">Prov or Mun Gov</td> <td style="text-align: center;">Int'l</td> </tr> </table>						Industry	Uni	Fed Gov	Prov or Mun Gov	Int'l
Industry	Uni	Fed Gov	Prov or Mun Gov	Int'l							
2. Indicate what programs administered by DRDC CSS that you have contributed to as a project/study partner:	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%;"></td> <td style="width: 20%;"></td> <td style="width: 20%;"></td> <td style="width: 20%;"></td> <td style="width: 20%;"></td> </tr> <tr> <td style="text-align: center;">CRTI</td> <td style="text-align: center;">PSTP</td> <td style="text-align: center;">CPRC</td> <td colspan="2" style="text-align: center;">None</td> </tr> </table>						CRTI	PSTP	CPRC	None	
CRTI	PSTP	CPRC	None								
3. Indicate DRDC CSS funding importance in relation to your own organizations' funding available for collaborative public security S&T projects:	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%;"></td> <td style="width: 20%;"></td> <td style="width: 20%;"></td> <td style="width: 20%;"></td> <td style="width: 20%;"></td> </tr> <tr> <td style="text-align: center;">Not imp</td> <td style="text-align: center;">Of little imp</td> <td style="text-align: center;">Important</td> <td style="text-align: center;">Very important</td> <td style="text-align: center;">Extreme imp</td> </tr> </table>						Not imp	Of little imp	Important	Very important	Extreme imp
Not imp	Of little imp	Important	Very important	Extreme imp							
4. Indicate DRDC CSS funding importance in relation to other government funding available for collaborative public security S&T projects:	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%;"></td> <td style="width: 20%;"></td> <td style="width: 20%;"></td> <td style="width: 20%;"></td> <td style="width: 20%;"></td> </tr> <tr> <td style="text-align: center;">Not imp</td> <td style="text-align: center;">Of little imp</td> <td style="text-align: center;">Important</td> <td style="text-align: center;">Very important</td> <td style="text-align: center;">Extreme imp</td> </tr> </table>						Not imp	Of little imp	Important	Very important	Extreme imp
Not imp	Of little imp	Important	Very important	Extreme imp							
5. Indicate how DRDC CSS Programs have contributed to public security S&T knowledge (i.e., S&T awareness, understanding, skill development):	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%;"></td> <td style="width: 20%;"></td> <td style="width: 20%;"></td> <td style="width: 20%;"></td> <td style="width: 20%;"></td> </tr> <tr> <td style="text-align: center;">No cont</td> <td style="text-align: center;">Minor cont</td> <td style="text-align: center;">Solid cont</td> <td style="text-align: center;">Sig cont</td> <td style="text-align: center;">Very sig cont</td> </tr> </table>						No cont	Minor cont	Solid cont	Sig cont	Very sig cont
No cont	Minor cont	Solid cont	Sig cont	Very sig cont							
6. Indicate how DRDC CSS Programs have contributed to public security interoperability (i.e., horizontal S&T collaboration, standards development):	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%;"></td> <td style="width: 20%;"></td> <td style="width: 20%;"></td> <td style="width: 20%;"></td> <td style="width: 20%;"></td> </tr> <tr> <td style="text-align: center;">No cont</td> <td style="text-align: center;">Minor cont</td> <td style="text-align: center;">Solid cont</td> <td style="text-align: center;">Sig cont</td> <td style="text-align: center;">Very sig cont</td> </tr> </table>						No cont	Minor cont	Solid cont	Sig cont	Very sig cont
No cont	Minor cont	Solid cont	Sig cont	Very sig cont							
7. Indicate how DRDC CSS Programs have contributed to public security emergency planning, responder and receiver S&T advancement (transition and exploitation of innovative instruments):	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%;"></td> <td style="width: 20%;"></td> <td style="width: 20%;"></td> <td style="width: 20%;"></td> <td style="width: 20%;"></td> </tr> <tr> <td style="text-align: center;">No cont</td> <td style="text-align: center;">Minor cont</td> <td style="text-align: center;">Solid cont</td> <td style="text-align: center;">Sig cont</td> <td style="text-align: center;">Very sig cont</td> </tr> </table>						No cont	Minor cont	Solid cont	Sig cont	Very sig cont
No cont	Minor cont	Solid cont	Sig cont	Very sig cont							
8. Indicate how DRDC CSS Programs have contributed to public security behaviour relevant to prevention, preparation, response and recover activities (such as risk-based policies, strategies and action plans, risk- and capability-based investments, and increased critical infrastructure resiliency):	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%;"></td> <td style="width: 20%;"></td> <td style="width: 20%;"></td> <td style="width: 20%;"></td> <td style="width: 20%;"></td> </tr> <tr> <td style="text-align: center;">No cont</td> <td style="text-align: center;">Minor cont</td> <td style="text-align: center;">Solid cont</td> <td style="text-align: center;">Sig cont</td> <td style="text-align: center;">Very sig cont</td> </tr> </table>						No cont	Minor cont	Solid cont	Sig cont	Very sig cont
No cont	Minor cont	Solid cont	Sig cont	Very sig cont							
9. Indicate how DRDC CSS Programs have contributed to Canada's economic confidence, public confidence (i.e., in continuity of government and public security threat identification, assessment and response), and national emergency management system confidence:	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%;"></td> <td style="width: 20%;"></td> <td style="width: 20%;"></td> <td style="width: 20%;"></td> <td style="width: 20%;"></td> </tr> <tr> <td style="text-align: center;">No cont</td> <td style="text-align: center;">Minor cont</td> <td style="text-align: center;">Solid cont</td> <td style="text-align: center;">Sig cont</td> <td style="text-align: center;">Very sig cont</td> </tr> </table>						No cont	Minor cont	Solid cont	Sig cont	Very sig cont
No cont	Minor cont	Solid cont	Sig cont	Very sig cont							
10. Indicate how DRDC CSS Programs have contributed to enhanced public security S&T R&D partnering:	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%;"></td> <td style="width: 20%;"></td> <td style="width: 20%;"></td> <td style="width: 20%;"></td> <td style="width: 20%;"></td> </tr> <tr> <td style="text-align: center;">No cont</td> <td style="text-align: center;">Minor cont</td> <td style="text-align: center;">Solid cont</td> <td style="text-align: center;">Sig cont</td> <td style="text-align: center;">Very sig cont</td> </tr> </table>						No cont	Minor cont	Solid cont	Sig cont	Very sig cont
No cont	Minor cont	Solid cont	Sig cont	Very sig cont							

Annex H

Question
11. Indicate how DRDC CSS Programs have contributed to enhancing Canada's S&T credibility and image:
12. Overall DRDC CSS Program Satisfaction:

Rating scale (questions 2-12 & 20 scale: 1-5)				
No cont	Minor cont	Solid cont	Sig cont	Very sig cont
Below exp	Some-what below exp	Meets exp	Some-what above exp	Above exp

13. How have your role or responsibilities been affected by the DRDC CSS programs and activities (R&D funding, community of practice or cluster activities, AHRA, capability-based planning approach, etc.)?

14. What are the major successes of the DRDC CSS programs?

15. How are the DRDC CSS programs relevant?

16. Do you have any concerns about the DRDC CSS programs?

17. If you could change any aspect of the DRDC CSS programs, what would it be?

18. Indicate if/how a CRTI/PSTP/CPRC project/study that you are aware of has been leveraged after its completion in order to further the operationalizing of S&T: (Project/Study # and/or Name: _____)

19. Other comments:

Annex I—CRTI Evaluation Matrix

Relevance

1. Continued Need for Program

- **Evaluation Question**
 - Is there a need for the CRTI?

- **Performance Indicators**
 - Extent to which the CRTI continues to address a demonstrable need:
 - assessment of the initial need for the project,
 - assessment of the current state of the need for the project,
 - new conditions or trends that may influence needs in this area, and
 - perception of continued need.

- **Data Sources**
 - Annual GoC and DND reports;
 - *Canada First Defence Strategy*;
 - Official DND documentation;
 - Reports of programs and activities funded through the CRTI;
 - MOUs for the programs and activities funded by the CRTI;
 - Key contacts (stakeholders and recipients of CRTI funding and departmental representatives); and
 - Public or private sector reviews, reports and/or studies.

- **Data Collection / Analysis Methods (Quantitative and Qualitative)**
 - Document reviews;
 - Interviews; and
 - Stakeholder surveys (as applicable).

2. Alignment with Government Priorities

- **Evaluation Question**
 - Is the CRTI consistent with government policies and priorities?

- **Performance Indicators**
 - Linkages to federal government policies and priorities; and
 - Linkages to DND's policies, priorities and strategic outcomes (PAA).

- **Data Sources**
 - Speech from the Throne;
 - GoC and departmental policies;
 - Annual GoC and DND reports;
 - *Canada First* Defence Strategy;
 - DND PAA;
 - Official DND and DRDC documentation; and
 - Key contacts.
- **Data Collection / Analysis Methods (Qualitative):**
 - Document reviews; and
 - Interviews.

3. Alignment with Federal Roles and Responsibilities

- **Evaluation Question**
 - Does the CRTI align with current federal roles and responsibilities?
- **Performance Indicators**
 - Degree of alignment between the CRTI activities and GoC roles and responsibilities;
 - Degree of alignment between the CRTI activities and DND/DRDC roles and responsibilities; and
 - Evidence of the need to protect a perceived public good.
- **Data Sources**
 - Speech from the Throne;
 - GoC and departmental policies;
 - Annual GoC and DND reports;
 - *Canada First* Defence Strategy;
 - PAA;
 - Official DND and DRDC documentation;
 - Public or private sector reports, studies and reviews; and
 - Key contacts.
- **Data Collection / Analysis Methods (Qualitative)**
 - Document reviews; and
 - Interviews.

Performance (Effectiveness, Efficiency and Economy)

4. Achievement of Expected Outcomes (Effectiveness)

- **Evaluation Questions**
 - Do the projects and activities funded through the CRTI meet their expected results?
 - Have CRTI activities contributed to increased capability and knowledge among stakeholders?
 - Have CRTI activities complemented or duplicated other S&T activities?
 - What is the extent of synergy between science clusters?
 - Were there any unexpected impacts (positive or negative) on the CRTI activities?

- **Performance Indicators**
 - Degree to which the CRTI projects and activities achieve their expected results and contribute to GoC / DND / DRDC objectives;
 - extent of progress towards outputs identified in the logic model, and
 - extent of progress towards outcomes identified in the logic model;
 - Degree to which the CRTI projects and activities have impacted the capability, capacity and knowledge of partner organizations;
 - Level of stakeholder satisfaction with the CRTI projects and activities; and
 - Identified unexpected impacts and external or internal forces affecting CRTI projects and activities (i.e., barriers to success).

- **Data Sources**
 - CRTI documentation, including working papers, reports of programs and activities funded by CRTI; CRTI annual reports; CRTI reviews and financial reports;
 - Documentation, including CSS annual activities reports, audits of financial statements, and performance audits;
 - Documentation outlining CRTI relationships with departments, organizations and agencies at the federal, provincial and municipal levels;
 - MOUs for programs and activities funded by the CRTI;
 - Annual reports from the programs and activities funded by the CRTI;
 - Official DND and DRDC documentation;
 - Public or private sector reports, studies and reviews; and
 - Key contacts.

- **Data Collection / Analysis Methods (Qualitative and Quantitative)**
 - Document reviews;
 - Interviews; and
 - Stakeholder surveys (as appropriate).

5. Demonstration of Efficiency and Economy

- **Evaluation Questions**
 - Are the most appropriate and efficient means being used to achieve the outcomes of the CRTI? Is there duplication of effort or room for improvement?
 - Are there more appropriate or effective alternatives for delivering the CRTI projects and activities?
 - Are there appropriate governance structures in place to deliver and manage the CRTI?
 - Are resources allocated and spent as intended?
 - Do the resource levels appropriately reflect the scope of activities?

- **Performance Indicators**
 - Evidence that the means to deliver CRTI projects and activities are effective;
 - Evidence that CRTI projects and activities are performing efficiently;
 - Evidence that CRTI projects and activities are providing value for money;
 - Comparisons to analogous organizations and activities in other countries;
 - Extent to which the governance structure has worked effectively;
 - identified suggestions for improvement to the governance structure, and
 - extent to which the project demonstrates principles of good governance (participatory, transparent, responsive, consensus orientated, accountable, etc);
 - TB submission funding aligns with activity and project budget allocations and expenditures;
 - projects and activities are realistic in terms of funding,
 - budget deficits or surpluses, and
 - opinions on adequacy of resource levels given the scope of project activities.

- **Data Sources**
 - Annual reports of the programs and activities that are funded by the CRTI;
 - Program and activity Performance Measurements Frameworks;
 - Program and activity performance data;
 - Documentation, including annual activities reports; audits of financial statements, and performance audits;
 - Official DND documentation;
 - Public or private sector reports, studies and reviews; and
 - Key contacts.

- **Data Collection / Analysis Methods (Qualitative and Quantitative)**
 - Document reviews;
 - Interviews; and
 - Stakeholder surveys (as appropriate).