



CANADIAN POLICE RESEARCH CENTRE

Led by DRDC Centre for Security Science



Harnessing Science and Technology for Canada's Emergency Responders

SUMMARY REPORT 2006 - 2010

Corporate Author
Original signed by DRDC Centre for Security Science

DRDC Centre for Security Science
222 Nepean St. Ottawa K1A 0K2

Approved for release by
Original signed by Dr. Anthony Ashley

Dr. Anthony Ashley
Director General
DRDC Centre for Security Science

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NRC · CMRC



DRDC Centre for Security Science: A Vital Resource to the Responder Community

A Message from the Director General



The Department of National Defence (DND) and Public Safety Canada recognize the imperative of collaborating to address Canada's national public safety and security objectives. In responding to the challenges of today's ever-changing security landscape, the two organizations created the

Defence R&D Canada – Centre for Security Science (DRDC CSS) in 2006 to provide science-based support to national strategies, policies, and operations. This centre of excellence is dedicated to applying science and technology (S&T) research and methodologies to strengthen Canada's ability to prevent, prepare for, respond to, and recover from accidents, natural disasters, and terrorist and criminal acts that impact the safety and security of Canadians.

Building on the success of the Chemical, Biological, Radiological-Nuclear and Explosives (CBRNE) Research and Technology Initiative (CRTI), a program initiated in 2002 to strengthen Canada's response to potential CBRNE threats, DRDC CSS was mandated to expand the scope of public safety and security S&T to include the broad range of threats and risks faced by the community. A key element of these efforts is to continue to develop and foster strong relationships between decision and policy-makers, emergency and security planners, and the responder community.

In 2007, DRDC CSS joined forces with the Canadian Police Research Centre (CPRC), a program with a newly expanded mandate to serve fire and emergency

medical services (EMS) along with law enforcement. In addition to providing responders with integrated access to multiple programs and greater leverage from its investments, this alliance is critical to strengthening relationships and creates an unprecedented opportunity to collaborate with all stakeholders to help ensure CPRC is working toward solutions that fulfill its mandate.

CPRC has undergone many changes in recent years as the program continues to integrate its business practices and program activities within DRDC CSS's organizational structure. Priorities for the next year include continuing the establishment of CPRC's headquarters in Regina, expanding activities relevant to fire and EMS, continuing to support law enforcement, and gaining a better understanding of emergency responder requirements. We are also investigating possibilities for stronger emphasis on testing and evaluation activities to help serve responders' shorter-term requirements.

In this report, you will learn about CPRC's diverse projects and initiatives, carried out from 2006 to 2010. While each activity fulfills a unique responder need, all outcomes have one commonality – helping to protect responders as they safeguard our citizens, infrastructure, and economy.

Dr. Anthony Ashley
Director General, DRDC CSS

A Rich Past—A Bright Future

A Message from the Chairman of the CPRC Advisory Board



The Canadian Police Research Centre (CPRC) is steadfastly committed to harnessing S&T to strengthen the capabilities of emergency responders. This report provides an overview of CPRC's activities from 2006 to 2010, beginning at a time when the program was mostly shaped by law enforcement priorities, through a period of great transformation as it was integrated as a program under DRDC CSS, to post-integration activities. This report also defines the program's new structure and business delivery model, efforts which have spearheaded the expansion of CPRC's mandate to serve the S&T needs of all emergency responders.

CPRC's expanded focus now includes fire and EMS, an adjustment precipitated by changes to the emergency responders' role resulting from the complex challenges imposed by the evolving public safety and security landscape. S&T is at the core of all matters of public safety and security, but its advances can also manifest in some unfavorable ways. While the evolution of S&T can provide many new advantages to those tasked with public safety and security, it can also equip the criminal element with new tools that can be used to disrupt society. Organizations like CPRC recognize the critical importance of providing emergency responders with the best equipment and knowledge needed to protect us against any potential threats. Such organizations play a valuable role in helping the responder community level the playing field by contributing to the development, testing, and exploitation of emerging and innovative public safety solutions for Canadians.

The three traditional emergency services — police, fire, and EMS — understand the advantages of consolidating their efforts in areas where significant commonality exists. Community-based service delivery models and dedication to providing optimal service in partnership with Canadian communities are core common principles of all emergency services. Responders have learned to work together as a team on behalf of, and in partnership with, the public. Within this context and in the spirit of cooperation, CPRC's S&T delivery model fosters collaboration through the creation of multi-disciplinary project teams that work closely with communities and responders to bolster this approach.

As Chairman of CPRC's Advisory Board, I am pleased to have this opportunity to highlight the program's achievements and demonstrate how CPRC is delivering on the requirements of Canada's emergency responders. We greatly appreciate your continued interest in the CPRC program and expect that upcoming reports will indicate even broader engagement and collaboration to harness S&T solutions that are vital to strengthening our emergency responders' ability to address public safety challenges.

Chief Clive Weighill
Chairman, CPRC Advisory Board

A New Chapter for CPRC

The CPRC Tradition of Excellence Continues



Welcome to CPRC's *Summary Report for 2006–2010*, a look at our program's areas of focus and accomplishments over a five-year period. The report covers two distinct phases in CPRC's history: CPRC as part of the National Research Council; and CPRC as a program within DRDC CSS.

It also highlights the contributions that CPRC has made to the development and evaluation of innovative projects, tools, approaches, and practices that are now or will soon be in the hands of police, firefighters, and emergency medical personnel across the country.

The key to CPRC's success can be attributed to its efforts in engaging the emergency responder community, whether to convey the need for a new solution to address a capability gap or working with industry to continuously advance the products developed to fill this gap. For example, the majority of the projects on CPRC's roster are the result of consultative sessions with emergency responders in which priorities are identified. These priorities are then addressed through the Calls for Proposals process. Secondly, through participation in CPRC's technical committees, emergency responders are provided with an opportunity to share their first-hand contextual accounts of "life on the streets." Such critical information assists project partners in gaining a better understanding of responder requirements to guide them in the execution of projects and ensure that results meet the needs of the emergency responder community. Finally, through its link to CPRC, the emergency responder community can influence the development of new innovative public safety and security solutions and the advancement of existing ones as CPRC maintains close ties with Canada's innovation network.

A critical success factor lies in the way CPRC is able to leverage DRDC's 60 years of experience as a world leader in defence and security S&T in combination with CPRC's 30 years of experience working closely with emergency responder communities. Combining our expertise serves to strengthen existing partnerships, cultivate new ones, and foster innovation for the benefit and safety of Canadian emergency responders and the public they protect.

With this summary report, we proudly present the results of CPRC's efforts from 2006 to 2010. In the course of striving to achieve our goals, we have received prestigious awards in recognition for our contributions to the emergency responder community. Our ambitious goals for the years ahead include continuing to diversify our project portfolio to include more projects related to fire and EMS, while continuing to build on our successes in the field of law enforcement. We will also continue to work diligently to fully establish our headquarters in Regina and ramp up our efforts to put in place a Living Lab environment where the participation and feedback from the entire community, including local police and fire services, and EMS, the Regina Airport Authority, Casino Regina, and local schools will enable real-time testing for equipment, procedures, delivery protocols, and standards. And finally, we will strengthen our linkages with the emergency responder community and encourage collaboration between responders and other innovation sectors such as industry, academia, and the federal S&T community.

I hope you enjoy reading about our successes, which clearly demonstrate the benefits of working together to enhance the safety of our citizens, infrastructure, and economy. We look forward to building on this legacy.

Steve Palmer

Executive Director, Canadian Police Research Centre

CPRC AWARDS : 2006 -2010

- April 2008: The National Award for Public Safety from the Canadian Wireless Telecommunications Association was awarded to CPRC's CITIG initiative (Canadian Interoperability Technology Interest Group)
- 2008 Honourable Mention Award Recipient in partnership with the Calgary Police Service for the National Study on Neck Restraints in Policing
- November 2008: The Excellence in Technology Award in the Small Agency Division from the International Association of Chiefs of Police (IACP) was awarded to CITIG
- December 2008: Team Award, On Scene 2008, in recognition of significant achievement in creating and staging the inaugural multi-agency training event for frontline emergency responders
- August 2009: The Canadian Association of Chiefs of Police (CACP) Motorola Award for Excellence in Emergency Preparedness for the CITIG Initiative, National Winner

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1. About the Canadian Police Research Centre

Mission

Harnessing S&T knowledge to strengthen police, fire, and EMS across Canada through research, development of standards, product evaluation, and technology transfer.

A Tradition of Excellence

For more than 30 years, The Canadian Police Research Centre (CPRC) has nurtured the development of new technologies that help protect Canadian communities and emergency responders.

CPRC's origins date back to 1979 when its predecessor, the Canadian Program of Science and Technology in Support of Law Enforcement (CPOSTISOLE), was established as a partnership between CACP, RCMP, National Research Council of Canada (NRC), and Canadian Police Association (CPA). Projects funded through the program resulted in innovative advancements in police safety gear, forensic entomology, and cyber-safety for children.

In 1990, NRC's Industrial Research Assistance Program (NRC-IRAP) helped re-launch CPOSTISOLE as the Canadian Police Research Centre, adding a new dimension to the existing alliance between policing and science communities by forming relationships with private industry to facilitate the transition of technology from the laboratory to the marketplace and into the field.

Prior to 2006, CPRC had been expanding its focus to meet the technology needs of the broader emergency responder community. With rising technical challenges, this need continued to grow and all responder organizations felt it was imperative that



they have access to the scientific advice that CPRC had been disseminating to the law enforcement community in an official capacity. In 2006, the program's proponents began writing letters to high-ranking officials, urging them to communicate their support to integrate CPRC within DRDC CSS. In 2007, the Government of Canada recognized and formalized CPRC's valuable role in the support of S&T in policing and public safety across Canada through research, development of standards, and product evaluation. The government therefore committed to constitute CPRC as a formal federal government program under DRDC CSS, establish its headquarters in Regina, and expand its activities beyond the traditional policing community to serve a broader client base of emergency responders, including firefighters and EMS personnel.

2. CPRC Joins DRDC CSS

A New Era

In 2007, CPRC entered a new era when the federal government restructured it as a formal Government of Canada program to be led by DRDC CSS, Canada's S&T leader in support of national public safety and security priorities. DRDC CSS now leads a suite of three complementary public safety and security programs – CPRC, Chemical, Biological, Radiological-Nuclear and Explosives (CBRNE) Research and Technology (R&D) Initiative (CRTI), and Public Security Technical Program (PSTP) — to achieve its mission to strengthen Canada's ability to anticipate, prevent, prepare for, respond to, and recover from acts of terrorism, crime, natural disasters, and serious accidents. This is accomplished through collaboration, investments in research and development (R&D), testing and evaluation of concepts and technologies, and by applying scientific methodologies and expertise to support policy development, as well as emergency and security planning and operations.

Redefining CPRC

CPRC's move to DRDC CSS created the opportunity to strengthen new and existing partnerships and foster innovation for the benefit and safety of Canadian emergency responders but it also created unique challenges. The organizational structure and daily operations of CPRC needed to be formalized and integrated with those of its new parent organization, while continuing its ongoing project work and taking on additional projects and activities in the realms of fire services and EMS. CPRC aligned its business planning activities with DRDC's environment and created improved synergies between itself and other DRDC CSS stakeholders, and synchronized its priorities to better support key Government of Canada public safety and security issues. During this time, CPRC focused on continuing its extensive consultation activities, undertaking preparations for establishing a headquarters in Regina, moving forward with initial recruitment, and coordinating project planning efforts.

DRDC CSS is drawing upon CPRC's knowledge and experience to better engage police, fire, and EMS communities as it works to identify and develop



linkages with other groups within its partner organizations with a view to providing a more comprehensive suite of products and services to the responder organizations.

To be effective in ensuring that the needs and priorities of the emergency responder community are addressed, CPRC engaged in:

- Community outreach: fostering its relationships with the police, fire, and EMS communities to help identify key issues and priorities, and conducting annual gap analyses. CPRC made it a priority to seek out sponsors within the emergency responder communities to help transition S&T outcomes from the laboratory into the hands of responders;
- Demonstrating strength as an S&T information broker. CPRC established its credibility by nurturing the development of new technologies that help protect Canadian communities and emergency responders in times of crisis. Many CPRC projects have resulted in innovative tools, approaches, and practices that are now used every day by police, firefighters, and EMS personnel across the country.
- Identifying emergency responder capability gaps and requirements through consultations, surveys, foresight analyses, and the identification of S&T capability gaps from the public safety community.



To successfully deliver its program elements, CPRC has focused on:

- Developing and executing projects based on recommendations by the Science and Technology Advisory Committee (STAC) and by emergency responder communities;
- Delivering on projects resulting from competitive Calls for Proposals; and
- Communicating the results of projects to the emergency responder communities to enable the integration of results with their service practices.

Moving Toward a Full-Service S&T Program for Emergency Responders

In 2007, the federal government decided to establish CPRC's headquarters in Regina, which provides a rich pool of CPRC allies (the RCMP Depot, Regina Police College, Regina Police Service, Regina Fire and Protective Services, the Regina Qu'Appelle Health Region, University of Regina and its research park, Innovation Place). These partners can work with DRDC CSS and CPRC in identifying common

emergency responder needs, developing solutions, and testing and evaluating technology in an operational environment. The work in Regina will focus on three priority themes: increasing emergency responder safety; operational testing and evaluation of new technology; and establishing technology standards.

Collaborating with some of the first-rate responder facilities in Regina's community, CPRC made progress toward its goal of enhancing its capacity to act as a hub for the testing and evaluation of new technologies, standards, processes, and methodologies before, during, and after they have been integrated into operations through a Living Lab concept. The Living Lab is based on the concept of using the "real-world" as a test lab in which to evaluate the potential impact of new technologies prior to implementation.

CPRC is also playing a role in contributing to the development of a Security Cluster in Regina, which will consist of emergency responder organizations, governments, industry, academia, and other partners.

3. 2006-2010 Project Highlights

CPRC strives to ensure that the emergency responder community is better informed about the role and application of S&T in enabling their operations and equipment options and that Canadian industry has opportunity in this specialized field. CPRC undertakes projects whose successful completion will help achieve the following desired outcomes that are consistent with DRDC CSS's goals:

- Improving emergency responder safety and operational effectiveness
- Enhancing safety for Canadians and their communities
- Fostering synergies with the Canadian security industry

CPRC also plays the role of project partner when it collaborates in activities funded by other programs led by — CRTI and PSTP — that impact the emergency responder community.

3.1 Improved First Responder Safety and Operational Effectiveness

Improving the safety and operational effectiveness of all emergency responders is among CPRC's top priorities. CPRC has invested in a number of projects that impact all emergency responders by helping to effectively mitigate emergency situations while reducing the risks faced by responders.

CPRC-2008-005: Body Armour Safety

Body armour is among the key personal protective equipment (PPE) police officers rely on to protect their lives in the event of a shooting. Currently, there is no widely accepted practice to determine the proper replacement interval for body armour. Replacement policies range from five years, to coincide with the typical manufacturer's workmanship warranty, to indefinite service life — replacing a vest only after obvious physical damage, a sizing change requirement, or an officer's departure from service.

During a 2007 meeting of the Board of Directors of the Canadian Association of Chiefs of Police (CACAP), a motion was passed "that the CACAP ask



CPRC to investigate the issue of life expectancy of soft body armour with respect to issues including the manufacturer's warranty period and replacement time."

Users of body armour were legitimately concerned about when to replace their existing equipment. Replacement immediately at the expiration of the warranty (typically five years) might offer some assurance that new product performance is maintained throughout service life, but only if the warranty in fact assures performance. On the other hand, if it could be scientifically demonstrated that useful life might be extended for some time past five years without compromising user safety, the life-cycle cost of the armour could be dramatically reduced. This issue affects not only those who are interested in budget impacts, but also those who are directly affected by armour safety. In some cases, replacement concerns even become an issue for the courts, citing worker safety.



Service de police de la Ville de Montréal (SPVM)

In response, CPRC engaged industry partners to develop an Aged Armour Replacement Protocol. The resulting study has laid the foundation for several follow-up studies on the use and replacement of body armour.

CPRC-2008-005 a, b and c: Development of an Aged Armour Replacement Protocol

Building on the exploratory work done in 2007, CPRC implemented a subsequent project to investigate the degradation of ballistic armour material and life expectancy of soft body armour, including questions surrounding the manufacturer's warranty period and replacement time. CPRC solicited the expertise of DRDC Valcartier to design and implement a testing program to study the performance of armour retired from Canadian police forces. An industry partner was then contracted to conduct the testing, with oversight from DRDC Valcartier.

For the purposes of the project, 150 samples of decommissioned body armour solicited from Canadian police services were subjected to laboratory

ballistic tests. Tested body armour panels ranged in age from two to 17 years. The preliminary results indicated that age does not appear to correlate with ballistic performance. Older panels, for example, those 13 to 17 years old, performed better than six-to seven-year-old panels, which had the highest penetration rates during this round of testing. Perforations also occurred on panels as young as three years. This result led to speculation that the initial design and construction of the panels, not their age, were the leading factors in determining effectiveness.

These observations are considered preliminary, and the 150 samples upon which these findings were made are not necessarily representative of current in-service armour. Additional testing on a larger sample size will be conducted to ensure a sufficient database of results to meaningfully support conclusions.

The expected outcome of ongoing testing and evaluation will be an Aged Armour Replacement Protocol that will enable police services to determine, in a scientific manner, whether the aged armour they have in service is still safe for continued use.



TR-10-2008: Body Decomposition in an Aquatic Environment

Human bodies are frequently recovered from the ocean or washed ashore and require identification as well as determination of the cause and time of death. Body decomposition in an aquatic environment poses a different set of challenges as compared to bodies found on land. The former requires at least two divers, underwater cameras and other costly equipment, a boat and, in some cases, a remotely operated underwater vehicle. The depths to which the human remains have sunk also sets a safety limit, as forensic divers cannot go deeper than 30-36 metres on normal air alone, and require a nitrox mix and decompression time limits at the depths studied in this project.

While animal – primarily insect, – colonization of a body is a valuable method to estimate elapsed time since death for bodies on land, this same method cannot be applied to bodies found in water, as insects are rarely found in the marine environment. As well, many variables that have not been previously studied exist, such as the type of water (fresh, salt, brackish), water temperature, the fauna and their access to the remains, depth, season, oxygen levels, clothing, and cause of death itself.

To advance knowledge in this unexplored area, CPRC funded research led by the School of Criminology at Simon Fraser University in collaboration with the Victoria Experimental Network under the Sea. Remotely operated vehicles (ROVs), real-time cameras, and other instruments were used to examine decomposition in deeper water marine habitats, and to determine the impact of marine submergence.

A number of experiments were conducted in Saanich Inlet and Georgia Strait. An ROV was used to position a swine model underwater to observe the impact of submergence. An instrument array measured water chemistry, while remotely controlled cameras captured video footage and still images of the process. In each study, the model was observed several times a day until it was reduced to scattered bones. These studies followed the decomposition stages and included observing the animals scavenging on the remains in order to help explain artefacts and decomposition of a body submerged in deep coastal water off the BC coast.

This work provided valuable information on the scavenging and disarticulation of remains under such conditions and will be useful in assessing cases of human death in the water.

CPRC-9-1070: Unmanned Aerial Systems for Emergency Responders

Unmanned aerial systems (UAS) can be used as a safe, cost-effective means of gathering crime scene photographic evidence or situational awareness at tactical or disaster incidents, without risking the lives of emergency responders. Effective training is a critical component in exploiting this technology. CPRC has provided funding to the Canadian Centre for Unmanned Vehicle Systems to develop a training course for emergency responders to effectively operate micro UAS in compliance with Transport Canada's safety and air traffic regulations. A task force has been formed, consisting of law enforcement officers from various agencies in Quebec, Ontario, Saskatchewan, British Columbia, and the United States (US). The group has been working on a set of guidelines for departments that are considering purchasing UAS for implementation in their daily operations. Factors to consider include: selecting the appropriate model that suits intended use; privacy issues; sending sensitive data over a network; and the best use of the acquired photographs in court.

CPRC-2007-006: Use of Simulation Technology in Police Training

Unlike most professions, police officers cannot rely on on-the-job training when it comes to some of the dangerous aspects of their job, such as apprehending an armed suspect, responding to an active shooter, or operating emergency vehicles. Unfortunately, reproducing these high-stress situations in a training environment can be difficult, expensive, and dangerous.

Technologies such as shooting and driving simulators offer a solution to this issue by providing opportunities for staging mock scenarios, such as proceeding through intersections, driving in fog or icy road conditions, or using firearms in low-light situations. Simulation provides high-arousal training in a safe environment, which allows trainees to learn the skills to respond appropriately when under the stress and reality of deadly situations.

CPRC has joined forces with the RCMP Training Depot, the US Federal Law Enforcement Training Center, and the University of Regina to study the optimal use of simulation technologies in police



training. The study aims to determine the optimal amount, type, and combination of simulation and live training needed to achieve the desired skills. The study will continue for several years to follow the performance of police trainees as they progress in their career. This ongoing work will ensure that a significant data set is generated, which can be used to better understand skill retention and in-service requalification needs for driving and shooting.

CPRC-2007-001: Recovery of Human Remains in Fatal Fires

In 2008, CPRC funded a study conducted by an investigator from the Ontario Office of the Fire Marshal with participation from York Regional Police, Mercyhurst College, Wilfrid Laurier University, Waterloo Office of the Chief Coroner, and Malahide, Springwater, and Clearview fire departments. The objective of the study was to determine the effectiveness of applying archaeological methodologies at fatal fire scenes to increase the amount of human remains and other evidence recovered. This research focused on the recovery of human remains and associated artifacts in a fatal fire setting to test the hypothesis that excavators who lack training and experience in archaeological field methodologies could potentially have a negative influence on locating human remains and associated artifacts within a given scene.



Office of the Fire Marshal (OFM)

OFM's Greg Olson and a firefighter locate and remove evidence from a fire scene.

The results of the study demonstrated that the application of an archaeological-style search methodology contributes to greater success in recovering deceased individuals and artefacts associated with them from fatal fire scenes. By using this methodology, fire investigators are better equipped to more accurately reconstruct the event. This, in turn, contributes to a higher success rate for solving cases, which leads to bringing more criminals to justice.

CPRC-2008-003: Effect of Arson or Explosion on Latent Fingerprints

At any major crime scene investigation, one can expect to see a police crime scene technician searching for latent fingerprints. This scenario changes completely at a crime scene where arson is suspected, because the intense heat and excessive black soot render this task virtually impossible. Fire investigators work closely with the police to examine

the scene and recover physical evidence, but the recovery rate of latent fingerprints using traditional detection techniques on surfaces damaged by arson and explosives is extremely low. Anecdotal evidence indicates that fingerprint examinations are not performed at many arson scenes due to the lack of effective recovery techniques.

In 2009, CPRC provided funding for a collaborative study involving the RCMP's Forensic Science and Identification Services and Trent University. The objective of the study was to improve the poor recovery rate for latent fingerprint impressions on surfaces damaged by arson or explosives. Such improvement would contribute to a higher rate of crimes being solved by increasing the number of incriminating fingerprints found per scene. By subjecting latent fingerprints to environments that reflect arson or explosives scenarios and analyzing the resulting chemical residues, this three-phase project will deliver new methods for fingerprint detection.

It is expected that the impact of these new fingerprint recovery techniques will increase the rate of arson crimes being solved. Putting these dangerous criminals behind bars prevents them from starting other fires, thereby reducing further deaths and injuries and the ensuing social disruption. The higher clearance rate will also minimize the economic devastation caused to properties by repeat offenders.

TR-02-2008: Evolution of the Science and Technology Advisory Committee

In 2005, CPRC and the Canadian Standards Association (CSA) developed a concept to form the Canadian Responder Equipment Advisory Board (CREAB) with a mandate to provide expert advice on Canadian emergency responder equipment and standards requirements. In its early stages, CREAB closely resembled a US organization called the InterAgency Board (IAB), which was formed in 1998 to identify specialized anti-terrorism technology requirements. Since 1999, IAB has produced an annual Standardized Equipment List that has been evolving in harmony with the US Department of Homeland Security's Authorized Equipment List and Responder Knowledge Base.

In October 2007, representatives of CPRC and CSA met with IAB officials in Washington, DC, and observed the IAB fall quarterly meeting. During this visit, CPRC secured the right to grant access to the Responder Knowledge Base to Canadian emergency responders through the IAB.

In late 2007, cross-sections of the Canadian emergency responder community participated in workshops held by CPRC in Calgary and Montreal. These sessions led to defining a broader role and responsibilities for CREAB and its name was consequently changed to the Science and Technology Advisory Committee (STAC) to reflect the expanded mission. STAC is comprised of representatives of the six national emergency responder organizations, academia, standards organizations, and industry. Its mandate includes:

- Providing government programs and initiatives with direct access to national representatives of Canadian emergency responder communities, including the Joint Emergency Preparedness Program (JEPP), CBRN-JEPP, training, S&T, R&D, test and evaluation, standardization and



interoperability, communications, and technical interface on emergency management and public safety issues;

- Supporting federal programs by providing a solid fundamental foundation that takes full consideration of end-user needs and operational realities;
- Identifying operational capability gaps and assisting in prioritizing resource allocation against such gaps, using a risk-based, sustainable, and targeted capability building approach;
- Supporting federal programs by expanding the Technology Partner Associates outreach mechanism (developed by CPRC for the police community), to the EMS and fire communities;
- Participating in the review, evaluation, and modification of US and other international response contingencies, standards, training programs, and emerging technologies for adoption, adaptation, dissemination, and implementation, wherever suitable within the Canadian context; and
- Providing Canadian industry with access to the consolidated emergency responder community in the interest of promoting product development, evaluation, transference, and commercialization.

The first official STAC meeting was held in June 2008. Since then, STAC has assisted CPRC directly by helping to identify the gaps and investment priorities of Canadian emergency services, implementing process improvements relative to

CPRC's Call for Proposals, and providing advice and recommendations as to how CPRC should allocate over six million dollars in R&D project funding.

Other Works of Interest

TR-05-2008: Development of a Multi-hit Ballistics Test Procedure

To better protect Canada's emergency responders who wear protective hard body armour, CPRC partnered with the Department of National Defence (DND) and the US National Institute of Justice (NIJ) to fund a study aimed at determining the effects of multiple shots hitting hard body armour versus single shots. The goal of this project is to develop procedures that will be incorporated in the test standards for multi-hit testing of body armour.

CPRC-2008-011: Canine Ballistic Vest Evaluation

The purpose of this CPRC-funded project was to evaluate three ballistic- or slash-resistant vest designs for police dogs to determine their effects on the physical performance and endurance of the dogs, as well as their body temperature. The outcomes of this project provided canine units with objective information to help guide purchasing decisions and optimize the use of the vests and prevent heat stroke. The project was led by British Columbia Institute of Technology - Technology and Product Evaluation Group with the RCMP as a federal partner.

CPRC 9 - 1027: DNA Collection from Used Toothbrushes for Decedent Identification

The successful collection and extraction of a sufficient quantity and quality of DNA from a toothbrush depend on a number of factors including: the length of time the toothbrush was used by the deceased, the technique used to recover cellular material from the brush, and the technique used to extract DNA from the cellular material. The aim of this study was to develop recommendations for forensic laboratories on best practices for the task of DNA collection from a used toothbrush. The Alberta Department of Justice - Office of the Chief Medical Examiner, conducted the study with funding assistance from CPRC.



CPRC 9 - 1034: Improved Physical Models and Software for Bloodstain Pattern Analysis

The overall goal of this project was to improve the effectiveness of operations in crime scene bloodstain spatter analysis through the development of a software product, which will allow a quick assessment of likely impact scenarios using scientifically validated computer reconstructions. The software will help the investigative teams more effectively isolate the most likely causes of the crime under investigation. The easier and speedier method for eliminating unlikely scenarios will lead to significant cost savings. The research was conducted by the Ontario Police College and the University of Ontario Institute Of Technology, with funding from CPRC.

CPRC - 2008 - 013: Forensic Determination of Human Regionalism

Medical examiners sometimes have very little information to help identify human remains. The scope of this CPRC-funded project led by Simon Fraser University is to determine if human hair and toenail tissue have the potential to provide information as to where a victim has been living for a period of months or years prior to death. This regionalized information can help to narrow missing person searches and may lead to positive identification by other methods, such as DNA. The importance of this research will be primarily useful to aid human identification, but could also be applied to intelligence gathering, human trafficking, and confirming testimony.



TR-01-2007: National Study on Neck Restraints in Policing

A review of the legal history of the neck restraint in policing, as well as previous medical literature, indicated that there were inconsistencies as to the risk of the neck restraint technique, the safest type of neck restraint, and the threshold at which the officer can legally apply the technique. As a result of these inconsistencies, CPRC funded a study in which the current research pertaining to neck restraints in the policing environment underwent a medical review. The final report, prepared by the Department of Emergency Medicine – Vancouver Island Health Authority and the Calgary Police Service, provides a framework around which police agencies can make informed decisions.

CPRC 9 - 1022: Reduction of Firefighter Risk in Responding to Basement Fires

To help guide the safe and efficient use of aerosol suppression technology, CPRC funded a project led by ARA Safety that measured the effectiveness of an aerosol suppressant agent in basement fire scenarios and evaluated its impact on fire suppression. The data gathered contributed to the development of a recommended procedure to reduce risks to

firefighters when aerosol devices are deployed. The evaluations were held at the Toronto Airport Fire Training Centre – Fire and Emergency Training Institute (FESTI), with FESTI firefighters responding to the fires. The report was peer reviewed by a Fire Chief, a representative of the Ontario Association of Fire Chiefs, and a professional engineer with fire service experience.

CPRC 9 - 1072: Tri-Services Technology Capabilities Assessment-Developing Evergreen Online Evaluation Process (TTCA)

The Canadian Advanced Technology Alliance (CATA) led this ongoing CPRC-funded project whose objective was to identify how broadly and effectively emergency responders are using existing technology, and to gauge which technologies will be important in the near and mid-term future. The project produced an online assessment tool that could be used by Canada's emergency responder organizations to continually assess their technological capability. Project partners included CPRC, the Canadian Association of Fire Chiefs (CAFC), the Emergency Medical Services Chiefs of Canada (EMSCC), CACP, the University of Ottawa, and ePenso.com.

CPRC 9 – 1025: Introduction of Evidence Based Research for Tri-Sector Personnel

The goal of this CPRC-funded project, led by Premergency Incorporated, was to develop a gap analysis process model specific to the needs of EMS to be integrated into CPRC’s annual gap analysis process to assist in prioritizing and allocating future CPRC program investments. The resulting model will also be shared with the police and fire chiefs associations so that they may adopt and adapt it as appropriate. These efforts will ensure that all three services feed into CPRC’s annual gap analysis process based upon a common standardized methodology.

CPRC – 2008 – 006: Trauma Resilience Web Tool

Emergency responders are routinely exposed to traumatic events in the course of their duties. As such, they are at increased risk for long-term problems from traumatic stress. The objective of this project was to enhance the health and safety of emergency services personnel by designing and testing a stress resilience web tool that addresses the unique challenges presented by their working environments. The project surveyed evidence-based research on building resilience to traumatic stress to identify the best content and delivery mechanism suited to responders. A web-based tool was also developed to provide resilience in the intended users of the tool. The Southern Alberta Institute of Technology conducted the research with funding from CPRC.

CPRC – 2008 – 024: A Parallel Study between Resource Typing as Outlined in the American NIMS Document and the Levels of Service Required of the Police Forces of Quebec

The Federal Emergency Management Agency’s National Incident Management System (NIMS) includes a proactive and systematic approach to guide the emergency management activities of federal, tribal, state, and local government agencies. This approach includes resource typing, which is the process of classifying resources into types. Measurable standards, which identify the target capabilities of resources and the performance levels, serve as the

basis for creating the categories. This CPRC project was focused on the target response capabilities of law enforcement and K-9 squads during a variety of incidents. The objective was to draw a parallel between levels of police service in Quebec and the typed resources from the NIMS document that deal with police resources.

CPRC 2008 – 004: Use of Force Lexique

Imprecise French-English and English-French translations, as well as inconsistencies in terminology, can seriously distort the facts presented in court. The primary objective of this ongoing project is to create a bilingual “lexique” of common use of force terminology. The lexique will be used to translate documents produced by CPRC, École nationale de police du Québec, and others that have the potential to be used in court. The secondary objective is to provide francophone police officers with access to accurately translated information on the use of force. The lexique is a work-in-progress being managed by the École nationale de police du Québec.

TR-19-2008 – Alternative Trouser Construction for Police Service Members

In a small survey of female police officers across three police services in British Columbia, a large number of complaints arose on the fit and function of uniform trousers. Designed for both male and female officer using standard methods for mass tailoring of men’s uniforms, the trousers did not fit female officers properly and this put them at risk in physically exacting situations. The aim of this CPRC-funded project was to apply and evaluate alternative fabric technologies for the trousers of female officers for function and comfort using evidence-based evaluation methods. The research was conducted by the British Columbia Institute of Technology with support from police services in Delta and Vancouver.

3.2 Enhanced Safety for Canadians and Their Communities

CPRC is steadfastly committed to enhancing the safety of communities across Canada and around the world. To progress towards this goal, CPRC has invested in a number of projects and activities that will leverage knowledge and expertise to help generate

and disseminate valuable information, which will then guide planning and decision-making. As the responder community gains a better understanding of the facts and issues in the areas that affect the safety of all Canadians, the responders will improve their capabilities and help make Canada a safer place in which to live.

TR-04-2008: Detecting and Identifying Clandestine Drug Laboratories: Sensing Technology Assessment

Clandestine drug laboratories, the majority of which are producing methamphetamine, represent one of the most significant societal challenges facing Canada, in particular, British Columbia. Such laboratories are capable of producing large quantities of illicit drugs in production cycles that can often span less than 48 hours. Detecting drug labs quickly is, therefore, critical to reducing the drug supply on Canadian streets.

In 2007, CPRC funded research by the University of British Columbia that outlined the first phase of a larger project aimed at developing sensor technology targeted at detecting clandestine methamphetamine laboratories. The resulting report, released in 2008, provides detailed analysis of the most common methamphetamine manufacturing processes, and identifies the airborne chemicals released during manufacturing. Because each of these manufacturing processes has a unique chemical and temporal signature, these signatures can be used to distinguish methamphetamine laboratories from legitimate producers.

In the context of the target gases, the report also provides a detailed assessment of sensor technology that is either available or currently under development. The objective of the assessment was to identify the sensor technologies that would be most suitable for this application.

The University of British Columbia collaborated with local fire services' hazardous materials teams on experimental investigations and identified performance requirements for sensing technology.



TR-09-2008: Controlled Spectral Experiments and Biological Control of Cannabis

An important step towards eliminating illegal outdoor Cannabis (also known as marijuana) grow operations (grow ops) includes an analysis of the existing literature published by growers or Cannabis enthusiasts, along with reports from sources that include the United Nations, the US Drug Enforcement Agency, the Bureau for International Narcotics and Law Enforcement Affairs, the National Drug Intelligence Center, and the Treasury Board of Canada. However, there has never been a compilation of the most pertinent information from the various sources into one succinct report. In 2006, CPRC funded a project led by Titan Analysis Ltd. to provide a concise description of topics related to the characteristics of Cannabis to support the eradication efforts of law enforcement. The compilation of information was viewed as the first step in the development of a series of tools aimed at

better detection of, and subsequent control of, illegal Cannabis grow ops. The initial report covered the following topics in detail:

- Botany, distribution, and ecology,
- Chemical constituents,
- Genetics,
- Spectral characteristics, and
- Seizures and trafficking.

A separate report issued in 2007 focused on satellite detection of Cannabis to uncover outdoor grow ops. This study revealed that the spectral signature of Cannabis is different from other common vegetation types in western Canada. Authorities could, therefore, use airborne imaging technologies to identify these signatures efficiently and locate the most probable locations of grow ops.

CPRC 9 - 0005 Conducted Energy Weapons Strategic Initiative (CEWSI)

The subject of conducted energy weapons (CEWs) is a sensitive and high-profile global issue, generating controversy among both stakeholder groups and the public. Major concerns have been expressed in public and legal forums about the quality of the scientific research surrounding CEWs, especially questions related to electrical testing and the medical effects of the devices. Decisions surrounding the implementation of CEWs are made by government and law enforcement authorities based on a number of factors, including the suitability and effectiveness of the weapon and scientific research. Access to credible scientific and technical knowledge is essential to assist authorities in making these decisions.

In November 2008, a federal-provincial-territorial CEW working group was created to support ongoing communication and information sharing on the different CEW policies and practices. In October 2009, this group was asked to explore the development of a CEW research agenda in Canada. The CEW Strategic Initiative (CEWSI) was created as one of the activities to support this effort. Led by DRDC, in collaboration with Public Safety Canada, CEWSI partners include DRDC, Public Safety Canada's Policing Policy Directorate, and the Department of National Defence's Quality Engineering Test Establishment. The aim of CEWSI is to provide law enforcement authorities with scientifically based



Harry Turner – National Research Council of Canada

advice and methodologies for testing CEWs, and to identify the medical and technical knowledge areas requiring further research.

CEWSI's objectives are to: develop a CEW test procedure and performance measures for current models in use in Canada to ensure that CEWs are meeting technical specifications; recommend a test procedure and develop comprehensive performance measures for possible inclusion in a Canadian national guidance for the use of CEWs in Canada; convene a panel of medical experts to conduct an independent evaluation of existing research to examine the physiological impact of CEWs, identify research gaps, and recommend steps to address such gaps; and develop an approval process that could be applied to emerging less lethal weapons technologies.

The delivery of the CEWSI project will be staggered over a two-year period (2010-2012) as CEWSI explores the different research components involved.

TR-01-2008: First Responder Evidence Collection Protocol

In 2007, CPRC published the findings of a study that involved evidence collection protocols for emergency responders faced with the sudden, unexpected deaths of persons under physical restraint by police or EMS. The focus of the study was to raise medical understanding of both police investigators and EMS personnel about the events associated with sudden, unexpected death, and the value of certain evidence that needs to be collected to assist pathologists in determining the cause of death. For example, a



subject's core temperature prior to or at the time of death provides valuable insight, but police officers do not take the subject's temperatures and EMS personnel may or may not have taken it at that exact moment.

The study identified much of the data or observations that should be recorded, including what happens before, during, and after the incident. For example, providing details on the subject's interactions with paramedics (e.g., how the patient was transported, the subject's verbalizations or noises, and any breathing patterns or sounds) can have an important impact. The factors involved in sudden, unexpected death are complex and multi-faceted. Failure to collect the right evidence following a sudden, unexpected death can lead to misunderstanding of the circumstances surrounding the event. By engaging in the consistent, systematic collection of evidence, pathologists will have a better understanding of these circumstances.

CPRC 2008-001: RESTRAINT — Risk of Events in Subjects that Resist - Assessment of Incidence and Nature of Outcomes

This CPRC-funded project is the only epidemiologic study of sudden in-custody deaths in North America. Since 2008, data has been collected in situations where individuals experienced police use-of-force. The study began in Calgary, and has expanded to include police agencies and EMS in other urban centres across Canada, including Victoria, Edmonton, and Quebec City. Using a standardized police use-of-force form, prospective data collection will continue until spring 2012.

The data collected is being used to inform law enforcement agencies, the medical community, and the public about the epidemiology of police use-of-force, medical outcomes following police use-of-force,



and the determination of a case definition and fatality rate for a condition called excited delirium. Excited delirium manifests as a combination of delirium, psychomotor agitation, anxiety, hallucinations, speech disturbances, disorientation, violent and bizarre behaviour, insensitivity to pain, elevated body temperature, and superhuman strength. Excited delirium is sometimes called excited delirium syndrome if it results in sudden death (usually due to cardiac or respiratory arrest), an outcome that is sometimes associated with the use of physical control measures, including police restraint.

The study has already demonstrated that police use-of-force is very limited, that the majority of injuries following police use-of-force are minor, and that excited delirium is an uncommon but definable condition. Further study is ongoing to determine which features of excited delirium are predictive of sudden death in custody and to determine a case fatality rate. The study protocol is serving as a template for the national standardization of police use-of-force recording and is facilitating the development of a comprehensive yet succinct method for reporting subject characteristics during use-of-force events.

This study has already gained international recognition at the International Law Enforcement Forum and has resulted in several large-scale international collaborations, including the Seattle Working Group on Excited Delirium (sponsored by Penn State), the Less Lethal Weapons Medical Safety Advisory Board (sponsored by the US National Institute of Justice), the American College of Emergency Physicians Committee for the *White Paper Report on Excited Delirium Syndrome* (resulting in a publication), and upcoming collaboration with two renowned physicians on nine manuscripts that stem directly from completion of the study.

CPRC 2008-001 Roundtable for the Prevention of In-Custody Death

The problem of sudden and unexpected deaths of individuals while in various types of custody has recently been the subject of intense public interest. In mid-2008 (in part fuelled by the research CPRC had completed on sudden and unexpected deaths, restraint, and CEW), CPRC was approached by representatives of the Office of the Correctional Investigator Canada (OCI) to look at the potential of

creating a mechanism to address the broader issue of in-custody deaths in Canada. At that time, CPRC collaborated with OCI, the Commission for Public Complaints against the RCMP, the Ontario Ministry of Correctional Services and Community Safety, and the Ontario Ombudsman to establish a forum for preventing in-custody deaths. The group began scoping out the issues, the first of which was that no central repository of data existed at either the federal or provincial level.

In collaboration with its key partners, CPRC was part of a panel that presented study findings at the Canadian Criminal Justice Association Annual Conference. This project is ongoing.

Other Works of Interest

TR-07-2008: Development of a Geographic Information System (GIS) Model for Predicting Outdoor Marijuana Cultivation in Southern British Columbia

There are numerous undetected outdoor marijuana growing sites in southern BC. Traditionally, airborne surveillance has been used to detect these sites, but studies indicate that, for every site detected, three remain undetected. Airborne surveillance is a very effective but costly detection method, requiring dedicated helicopters that cannot cover the vast territory involved. To help improve the detection of these sites, CPRC funded a study to develop a new methodology that predicts possible growing sites based on complex criteria developed from known sites using a methodology called multi-criteria evaluation that models multiple factors and constraints in a GIS environment. The study was led by CPRC with research conducted by the Justice Institute of British Columbia.

TR-03-2008: Oral Fluid Testing Devices – Validation of Selected Commercial Products for Future Roadside Screening for Drugs

The demand for a quick and simple roadside oral-fluid testing device to screen for drugs, such as cocaine, opiates, and amphetamines, is rapidly increasing. With project funding from CPRC,



the Centre for Forensic and Security Technology Studies - British Columbia Institute of Technology tested three existing oral-fluid screening devices in order to examine their ease of operation, reliability, sensitivity, specificity, and kit cost.

CPRC - 2008 - 009: Nystagmus: Development of an Automatic System for the Detection of Impairment Based on Ocular Behaviour Analysis

Driving under the influence of alcohol, drugs, or medication remains a major cause of road deaths in Canada. The objective of this CPRC-funded project was to demonstrate the feasibility of developing a new compact prototype capable of automatically performing measurements that normally would be taken by a Drug Recognition Expert (a police officer specifically trained to identify drug impaired drivers). This system would conduct the eye convergence, pupil dilatation, and horizontal gaze nystagmus tests, and would also be capable of detecting blood alcohol content above 0.08 percent. The research was conducted by the Université du Québec à Trois-Rivières.

TM-06-2007: CPRC Survey of Canadian Police Services Use of Taser International 21-Foot Cartridges

CPRC developed a report that provides a summary of the use of Taser International 21-foot cartridges in Canadian law enforcement agencies and organizations in Alberta, BC, Ontario, and Saskatchewan. Research for the report involved surveying nine Canadian

law enforcement agencies about their use of the cartridges, and any problems experienced during their use. The study was conducted with participation from the following law enforcement agencies: Brantford Police Service, Calgary Police Service, Hamilton Police Service, Peel Regional Police, Regina Police Service, Saanich Police Department, Taber Police Service, Toronto Police Service, and Vancouver Police Department.

3.3 Fostering Synergies with the Canadian Security Industry

CPRC takes a proactive approach to helping industry understand the needs and requirements of Canadian responders by creating opportunities for emergency responders, government organizations, regulators, academia, and special interest groups to work directly with industry at the early stages of public safety product development. These meetings are a critical step in shaping product development that contributes to the safety and operational effectiveness of responders in the line of duty.

Vendor Outreach Forum

CPRC, along with CATA, co-hosted a series of first responder vendor outreach forums. These forums are designed to bring North American information and communications technology companies together with Canada's emergency responders to shape the direction of industry R&D and address current issues through cooperative action and the development of a technology roadmap for Canadian first responders. The forums have been identified by both vendors and emergency responders as an effective vehicle for bringing them together and enabling a rich exchange of intelligence, providing networking opportunities, and identifying solutions for immediate and future technological needs.

First Responder Technology Roadmap

The first responder technology roadmap concept is a consultative process designed to help industry, its supply chain, academic and research groups, and governments come together to identify and prioritize the technologies needed to support strategic R&D, marketing, and investment decisions. These technologies will be of critical importance to industry

in the next five to ten years. In developing the roadmap, companies within a sector jointly commit to identifying the critical technologies and skills required to effectively utilize solutions of the future. The roadmap is a means to facilitate joint decision-making on future R&D and skills development, and to establish a commitment to work together to address these challenges.

Collaborating with the Textile Industry

CPRC contributes to the advancement of PPE by creating opportunities for responders to meet with the textile industry on an annual basis. The objective of these meetings is to draft a "call to action" that outlines responder needs and requirements for future product development by the PPE industry.

3.4 CPRC Collaboration on CBRNE Projects

CPRC often collaborates with CRTI by contributing resources on CBRNE projects that impact the emergency responder community. The following outlines CRTI-funded projects in which CPRC was involved.

CRTI 09-0001SCP: Expedient Mitigation

In 2007, CAFC identified a crucial capability gap related to Canada's ability to minimize the impact of a CBRN agent release event by neutralizing and rapidly containing the hazardous material. CAFC recognizes that it is the responsibility of fire departments to neutralize a CBRN attack and that there is existing Canadian technology with great potential to address requirements associated with this responsibility. However, for this technology to reach its potential for deployment, it must be supported by appropriate training and procedures.

The objective of this project was to accelerate the development, from prototype to second generation, of fire department-oriented hardware. The project which was funded by CRTI, was led by CPRC, in collaboration with DRDC, CAFC, and Allen Vanguard. The hardware, known as the large portable decontamination system (LPODS), propagates surface decontamination foam (SDF), a material capable of neutralizing chemical and biological



agents for building remediation without damaging contaminated surfaces or sensitive equipment. DRDC Suffield originally developed and later adapted SDF to decontaminate military equipment so the equipment could be returned to service safely following exposure to CBRN agents.

As part of a pilot initiative, LPODSs were delivered to fire services in New Westminster, Calgary, Regina, and Montreal for ongoing testing and evaluation in an operational setting. The four services involved in the pilot also contributed to the development of the first version of universal standard operating procedures (SOP) and an operation and maintenance (O&M) training package.

Through the course of this pilot, the services involved will be creating scenarios to simulate potential CBRN incidents that could occur in their cities. For example, le Service de sécurité incendie de Montréal will be testing how the system could be used while responding to a threat in a metro station. Every six months, lessons learned will be communicated to CPRC in order for improvements to be made to the hardware or to the SOP and O&M packages.

CRTI 07-0105a: Operation Maple Leaf: New Canadian Response Capabilities for Explosive Technicians

Suicide bombs, large vehicle bombs, and radio-controlled explosive devices are the weapons of choice for today's terrorists. Because responders are faced with the dangerous responsibility of handling these devices, it is essential that Canadian explosives technicians are provided with the best and most advanced skills training available. The Advanced Technical CBRNE Training Program, also known as Operation Maple Leaf, aimed to provide these skills and ensure that responders are better equipped to counteract CBRNE threats. This project was funded through CRTI and originally led by the RCMP. In 2008, the responsibility for leading the projects was transferred to CPRC.

Operation Maple Leaf provided comprehensive training that, at the time, was unavailable in Canada, including the design, development, and implementation of four new courses for explosive technicians.

Participants had the opportunity to develop advanced skills in countering improvised explosive devices (IEDs) by working with new and emerging technologies. These skills included constructing sophisticated electronically initiated devices for training purposes, as well as reconstructing IEDs from post-blast debris. Participants learned advanced techniques for rendering safe a variety of devices, including body bombs and booby trap devices.

Canada is internationally recognized as a leader in IED countermeasures and explosives ordinance disposal. Explosives technicians from around the world traveled to Canada to participate in Operation Maple Leaf, including technicians from the US, Brazil, Belgium, Sweden, South Africa, Germany, Finland, Australia, Denmark, and Colombia.

CRTI 05 - 0016RD: Development of a Canadian Standard for Protection of Emergency Responders from CBRN Events

The events of September 11, 2001 prompted responder organizations to re-examine their CBRN capabilities and the need for a national PPE standard became a priority. As an initial step, emergency response managers sought guidance from organizations like the Royal Military College Canada, recognized experts in testing chemical protection suits and respiratory protection systems, and CRTI.

These discussions eventually led to a CRTI-funded project, Protecting Emergency Responders against Chemical and Biological Threats. The project's findings provided a foundation for a second project, which was led by Public Works and Government Services Canada's Canadian General Standards Board, with joint leadership from CSA. To achieve the project's objective of developing the first ever Canadian CBRN PPE standard, a technical committee consisting of emergency responder and government organizations, regulators, industry, academia, and special interest groups was formed to address issues

related to the different types of CBRN incidents and the corresponding level of protection needed. CPRC was represented on the technical committee, offering opportunities for responders to share their first-hand contextual accounts of dealing with CBRN incidents, and helped the S&T experts better understand how PPE is used on the front lines.

The standard will ensure that all Canadian responders are sufficiently protected by providing guidance on the following elements of CBRN PPE: selection, use, and care; capabilities and limitations; and requirements for whole-body protection to ensure individual components work together for maximum protection and responder performance. The standard will also provide industry with vital knowledge to accelerate the development of innovative technologies that meet responders' needs.

CRTI 08 - 0105RD: CBRNE-Recommended Equipment List

While emergency responders are committed to protecting Canadians from harm, it is essential that they are provided with the optimal equipment and the most advanced skills to ensure their own personal safety in the line of duty. CPRC is leading a project, funded through CRTI, to develop a CBRNE - recommended equipment list to enhance responder safety, streamline the planning and procurement process, ensure compliance with standards, improve the training cycle, and identify CBRNE technology that needs to be rigorously tested and evaluated by the S&T community. To build this list, CPRC formed a working group to bring together experts from the chiefs and membership associations of Canadian police, fire, and EMS, along with representatives from standards and training institutions, and subject matter experts in public safety and security S&T. The project's key deliverables will help responder organizations to identify local vulnerabilities, conduct comprehensive risk assessments, identify and fill gaps in their current capabilities, and prioritize allocation of resources with a view to risk reduction.

4. Strategic Initiative for Emergency Responder Interoperability

In 2007, CPRC helped establish the Canadian Interoperability Technology Interest Group (CITIG), an initiative that brings together representatives from public safety, industry, academia, government, and

“Communications interoperability refers to the ability of public safety agencies to talk across disciplines and jurisdictions via voice communications systems, exchanging voice or data with one another on demand, in real time, when needed, and as authorized.”

non-governmental organizations to collectively shape the future of Canadian public safety interoperability. Since its inception, CITIG has made significant strides in raising awareness

about, and prompting action to improve, public safety interoperability, one of the single most important issues facing emergency responders today.

Over time, CITIG has evolved into a partnership between CPRC, CACP, CAFC, and EMSCC, with significant support from Industry Canada, Public Safety Canada, and other federal partners. Canadian efforts have been bolstered by strong ties with organizations such as the US National Public Safety Telecommunications Council and the US Department of Homeland Security SAFECOM program.

National Meetings

The inaugural Canadian Voice Interoperability Workshop: A CITIG National Forum was held in Ottawa on March 26-28, 2008. The workshop brought together representatives from emergency responder agencies, emergency managers, other public safety providers, the military and Canadian Coast Guard, government agencies and utilities, non-governmental organizations in the emergency response and humanitarian aid sphere, academic and research institutions, and industry. The main outcome of the workshop was the identification of the need for a national interoperability plan. The workshop proved immensely popular and became an annual event.



From left to right: Deputy Director General Steven Chabot, then President, CACP; Chief Farr, then President, EMSCC; and Chief W. Burrell, then President, CAFC

In cooperation with Public Safety Canada, work on a national plan, then called the Canadian Communications Interoperability Plan (CCIP), began soon after the workshop, and the draft plan became the major discussion topic during the Second Canadian Voice Interoperability workshop held in Toronto from December 7- 10, 2008. Equally important, the presidents of Canada's three chiefs' associations, representing police and fire services, and EMS, demonstrated their support for the CCIP during the workshop when they signed a joint resolution calling for increased cooperation on addressing emergency responder interoperability issues.

By 2009, workshop efforts began expanding beyond voice communications, and the scope of the Third Canadian Voice Interoperability Workshop (held in Halifax November 15-18, 2009) broadened to help stakeholders gain an understanding of, and work toward making progress on, key issues, including:

- national and cross-border interoperability planning;

- provincial, regional, and local interoperability strategic planning;
- interoperability and the challenge of governance;
- trends in interoperability technology, including both voice and data-related issues;
- situational awareness, common/user-defined operating pictures, GIS systems, and blue force tracking.

Work in Nova Scotia brought about increased awareness about emerging issues like the P25 standard, offered the opportunity to refine and broaden the CCIP, began a national effort on data standards, and resulted in a call to move forward on creating the Public Safety Interoperability Centre (PSIC), a concept that is still in the exploration phase.

Forums for all Audiences

On October 11, 2007, the first ever Regional CITIG Interoperability Forum was held in Toronto. It brought together almost 70 people from across Canada as well as representatives from the US, and featured guest speakers, special presentations, and an interactive session that gave participants a chance to address interoperability issues from their own perspective.

Similar regional meetings were held from late 2007 to early 2010 in cities across the country, including Moncton, St. John's, Montreal, Toronto, Saskatoon, Calgary, Edmonton, Vancouver, Regina, Moncton, Gananoque, Winnipeg, Victoria, St. John, and Whitehorse. Each gathering featured speakers and focused on interoperability issues specific to the region, while providing participants with a national perspective. Many of the regional forums incorporated a workshop component that provided hands-on help for participants to build their own regional interoperability plan.

Equally important, a series of vendor outreach forums began in Toronto in 2008, followed by Calgary in 2009 and Halifax in 2010. These events were hosted in partnership with CATA and were designed to bring industry and public safety practitioners together. The forums offered industry partners a unique opportunity to educate participants on their products and services while providing emergency responders with a forum for discussing their future technology requirements to help guide industry.



CITIG'S Success Recognized

In April 2008, CITIG won a national award for public safety from the Canadian Wireless Telecommunications Association (CWTA). The award was made possible by CWTA together with host sponsors Bell Canada, MTS Allstream, Motorola Canada, Rogers Communications Inc., and TELUS. CITIG was honoured for making a positive contribution to public safety.

Later that year, CITIG accepted a 2008 IACP-iXP Excellence in Technology Award in the Small Agency Division during the 115th International Association of Chiefs of Police (IACP) Annual Conference in San Diego, California. CITIG was recognized for demonstrating "superior achievement and innovation in the field of communication and information technology."

Another highlight occurred in August 2009 when CPRC was presented with the inaugural CACP/Motorola Award for Excellence in Emergency Preparedness for the CITIG initiative during the Annual CACP Conference in Charlottetown, Prince Edward Island.

Communications Interoperability Strategy for Canada

Public Safety Canada's *Communications Interoperability Strategy* and *Action Plan* define a national vision to improve daily communications interoperability among emergency responders. The strategy and the supporting plan were developed through consultation with municipal, provincial, and national champions for enhanced communications interoperability,



and were supported through the engagement of the Canadian Council of Emergency Management Officials and the Senior Officials Responsible for Emergency Management.

Input facilitated through CITIG workshops was instrumental in the development of this strategy.

Interoperability Research

CITIG plays an important role in helping CPRC identify communications interoperability gaps and raise awareness of these issues within the public safety and security communities. Through these efforts, responder organizations have become more engaged in activities focused on improving communications interoperability, prompting greater participation in projects funded through CPRC's Call for Proposals process. In 2008, CPRC allocated more than \$325,000 in funding for nine initiatives that aimed to improve public safety agency interoperability in Canada. The following projects delivered specific outcomes related to the five elements of the interoperability continuum: governance, standard operating procedures, technology, training and exercise, and usage:

- **City of Ottawa Five-Year Interoperability Strategic Plan** – Ottawa Police Service led the effort to develop a five-year interoperability strategic plan for the City of Ottawa and its key partners in the National Capital Region. The plan, which was created in a public-friendly format that featured public consultation, was part of a coordinated, synchronized, and holistic approach to interoperability planning to ensure that cost-effective decisions would be made for the benefit of all partners.
- **Creation of Radio Communications Interoperability Committee for the Province of Quebec** – The Sûreté du Québec led the creation of a Radio Communications Interoperability Committee to coordinate a provincial plan for the interoperability of police radio communication in Quebec. The project provided provincial guidelines for interoperability in Quebec to ensure the safety of citizens both in routine police operations and in emergency situations, natural disasters, or terrorist events.
- **Maritime Provinces Interoperability** - In partnership with the provinces of New Brunswick, Nova Scotia, and Prince Edward Island, and with

the Maritime Radio Communications Initiative Working Group, CPRC led an initiative to provide emergency responders and the associated public sector with an interoperable radio communications system across the maritime provinces.

- **Engineering and Planning of Very High Frequency (VHF) Interoperability Pilot Programs** – Emergency Management BC spearheaded two pilot programs aimed at establishing the capability and procedure to enable first responders to communicate directly via radio during the response to a combined incident (i.e., involving more than one service or jurisdiction) using shared analog VHF simplex channels or VHF repeaters. The project improved first responder interoperability capability in rural parts of BC.
- **Evaluation of the Interoperability Capabilities between the Montréal Police Service’s Centre de commandement et de traitement de l’information (CCTI) and the City of Montréal Centre de coordination des mesures d’urgence (CCMU)** – The Service de police de la Ville de Montréal led this evaluation using the five pillars of the interoperability continuum (governance, SOPs, technology, training & exercise, and usage) to document the various aspects of the operation of the CCTI and interactions between the levels of command (strategic, tactical, and operational) at the time of major events to identify opportunities for improvement.
- **Emergency-Responder Interoperability Study: Governance, SOPs, and Technical Requirements** – With the help of the London Police Service, this research study identified the key drivers and inhibitors to interoperability as it relates to governance, SOPs, and technology requirements. The study provided a first-hand baseline of information regarding interoperability from police, fire, EMS, and coast guard organizations.
- **Interoperability Training Exercise in Halifax Harbour** – The Halifax Regional Police Service in conjunction with area partners planned and executed a tabletop exercise in Halifax Harbour for emergency response agencies. The main outcome was SOPs and usage rules for multi-agency marine base operations, as well as identification of major interoperability gaps.
- **The North East Avalon Interoperability Study** – This study went a long way towards identifying a single interoperability solution for the province of Newfoundland and Labrador. The spin-off benefit included fostering a higher level of cooperation between a long list of agencies, including Newfoundland & Labrador Fire & Emergency Services (NLFES), Royal Newfoundland Constabulary RNC, RCMP, Eastern Health Ambulance Service, Canadian Coast Guard and the Canadian Forces, among many others.
- **Public Safety Spectrum Requirement Study** – In April 2008, the York Regional Police led the development of a paper defining public safety radio spectrum needs for public safety providers in Canada in direct response to an Industry Canada request (Canada Gazette Notice SMSE-004-08). This included an analysis of the 700 MHz band changes that occurred in the US and laid the groundwork for a follow-up request by Industry Canada (Gazette Notice No. SMSE-018-10: Consultation on a Policy and Technical Framework for the 700 MHz band and Aspects Related to Commercial Radio Spectrum).
- **Radio Interoperability Governance: Best Practices in Canada** – The objective of this study, guided by the York Regional Police Service, was the development of best practices as they relate to the governance of radio systems being used to provide both voice and data radio interoperability between agencies of different levels of government.

The Unique Challenges of Cross-Border Interoperability

Canada and the US share several of the world’s busiest border crossings. Responders from coast to coast, including the Alaska borders with BC and Yukon Territory, face unique challenges in managing their responsibilities along the longest common border in the world. While responders are required to respect these “lines on a map,” criminals, fires, floods, and other natural disasters do not.

In May 2009, the US Department of Homeland Security Office of Emergency Communications and Public Safety Canada co-hosted the US



Cross Border Interoperable Communications Workshop held in Niagara Falls, New York. CITIG was a key member of this workshop's organizing committee. Other key government departments in attendance were Industry Canada, the US Federal Communications Commission, and the US National Telecommunications and Information Administration. A follow-up workshop was held in Canada in September 2010. During this event, held in Windsor, Ontario, cross-border workshop participants identified 10 priority areas to formally address communications interoperability challenges in support of cross-border operations.

Practitioner's Portal

On March 30, 2010, CITIG launched the Interoperability Practitioner's Portal (www.citig.ca) and within a month, CITIG membership reached 500 members. The website is practitioner-administered and hosted by the York Regional Police Service. The site was created in direct response to one of the action plans listed in CCIP. The portal has become an important vehicle for raising awareness about responder interoperability, getting timely information on interoperability developments, and providing a common place for practitioners to share best practices, tools, and templates.

5. The Way Forward

The future is promising for DRDC CSS and CPRC, which have followed an evolutionary path in keeping with the pace of an ever-changing safety and security landscape. Going forward, DRDC CSS is looking to develop a more integrated approach to its service delivery by harmonizing CRTI, PSTP, and CPRC to create one comprehensive public safety and security S&T program. DRDC CSS will continue to emphasize the value of mobilizing and sustaining the S&T community, ensuring that new technologies meet the true needs of responders and finding ways to effectively transition investments to end-user communities. CPRC will play a significant role in engaging the responder community in support of these objectives.

More specifically, CPRC will be enhancing its role as a testing and evaluation hub through the development of a “Living Lab” concept. As a hub, CPRC will provide

responders with a forum to contribute their knowledge and expertise to identify common needs, help shape the development of innovative technology, and evaluate technologies in an operational environment. Through this concept, responders will be testing and evaluating emerging technology at the pre-operational, operational, and post-operational stages as they work toward increasing operational safety, improving forensic techniques, and establishing technology standards that will help protect emergency responders as they safeguard communities across Canada and around the world. CPRC will soon undergo a name change to better reflect its focus on these activities.

Another priority for CPRC will be to expand the scope of its projects to better serve fire services and EMS, while continuing efforts on behalf of law enforcement. CPRC has already begun to successfully ramp up its



CPRC, together with CRTI and PSTP, are strengthening Canada’s ability to protect people, responders, and critical infrastructure from all hazards.



investments in projects for fire services with work underway in the areas of responder priorities and gaps analysis, fire suppression technology, human remains recovery, data collection to build a national fire incident database, and the effect of arson or explosion on latent fingerprints. In addition, CPRC has funded projects to establish a research agenda and to develop a national database to serve the EMS community. CPRC is also working with other programs under DRDC CSS to create a recommended equipment list to benefit all three responder groups.

Further efforts to enhance CPRC's support to the police, fire services, and EMS will focus on providing responders with greater access to the broader federal

science community through the networks created under DRDC CSS's suite of public safety and security programs.

DRDC CSS and CPRC are committed to providing leadership and support to help ensure that federal S&T investments respond to the realities of Canada's immediate and long-term public safety security challenges. Through such leadership and support, emergency responders, planners, and both policy and decision makers will have access to the latest S&T knowledge, tools, practices, and resources to protect Canadians today and in the future.

A. Further Reading

Scientific Reports

2006

TR-01-2006 (PDF 313 KB) – Conducted Energy Devices (CED) (commonly referred to as stun-guns or the trademark name TASER)

TR-05-2006 (PDF 6,893 KB) – CPRC Research Priorities and Related Services for Canadian Industry

2007

TM-03-2007E (PDF 64 KB) – Bibliography of Selected Resources on OC Spray and Other Chemical Irritants

TM-04-2007E (PDF 131 KB) – CPRC Survey of Canadian Police Services on the use of OC Spray During Training

TM-06-2007 (PDF 214 KB) – CPRC Survey of Canadian Police Services use of Taser International 21ft cartridges

TR-01-2007 (PDF 446 KB) – Neck Restraint Literature Review

TR-03-2007 (PDF 405 KB) – National Study on Neck Restraints in Policing

TR-04-2007 (PDF 1,635 KB) – Satellite Detection of Cannabis sativa Outdoor Grow Operations

2008

TR-01-2008_e – First Responder Evidence Collection Protocol

TR-02-2008 – Towards a Canadian Responder Equipment Advisory Board (CREAB)

TR-03-2008 – Oral Fluid Testing Devices

TR-04-2008 – Detecting and Identifying Clandestine Drug Laboratories

TR-05-2008 – The Development of a Multi-hit Ballistics Test Procedure

TR-06-2008 – Development of an Aged Armour Replacement Protocol

TR-07-2008 – Development of a GIS model for Predicting Outdoor Marijuana Cultivation in Southern British Columbia

TR-08-2008 – A Technology, Research and Development, and Emergency Preparedness Situational Analysis of Canadian First Responders

TR-09-2008 – Controlled Spectral Experiments and Biological Control of Cannabis sp.

TR-10-2008 – Determination of Elapsed Time since Death in Homicide Victims Disposed of in the Ocean

TR-13-2008 – Canadian Public Safety Spectrum Study

TR-14-2008 – Communications Interoperability Technical Report: North East Avalon Interoperability Study

TR-15-2008 – Communications Interoperability Technical Report: British Columbia Common Event Channel: Engineering and Planning of VHF Interoperability Pilot Programs

TR-16-2008 – Communications Interoperability Technical Report: National Capital Region Interoperability Project

TR-17-2008 - Créer un comité d'interopérabilité des radiocommunications policière dans la province de Québec

TR-18-2008 - Évaluation du centre de commandement et de traitement de l'information du SPVM et du CCMU de la Ville de Montréal

TR-19-2008 Alternative Trousers Construction for Police Service Members, Phase 1

TR-20-2008 – Communications Interoperability Technical Report: Setting a Voice Interoperability Roadmap: Summary Report from the Canadian Interoperability Technology Interest Group National Workshop

2009

DRDC CSS CR 2009-03 – Recovering Human Remains in a Fatal Fire Setting

DRDC CSS TN 2009-04 – The use of archaeological and anthropological methods in fatal fire scene investigation

DRDC CSS TN 2009-09 – A Parallel Study between the Resource Typing as outlined in the American NIMS document and the Levels of Service required of the Police Forces of Quebec

2010

DRDC Valcartier: CR 2010-117 – Aged Armour Testing Study Report on Results of 150 Samples