Canada – United States Border Radio Coverage

"Exercise. Exercise. Exercise"

Situation: Public Safety officials advised that a satellite is falling out of orbit. Toxic materials on board. Expected footprint of debris 50 km wide x 150 km long centered on East Mary Island, Thousand Islands area, N.Y. 22:54 local, Rock Port Ontario. Multiple reports of falling star sightings reported at 911 call center.

Mission: Locate and isolate debris. Determine risk to population.

Command and Control: Who can cover that area? Large body of water in the footprint requires multi-agency action from both sides of the border including Coast Guard.

One of the most important issues facing civil and military emergency responders is communications interoperability, commonly defined as the ability of emergency responders - police officers, firefighters, emergency medical services - to communicate to whom they need to, when they need to, as required and authorized. From day-to-day incidents to large-scale emergencies, emergency responders are often disadvantaged by the inability to communicate or share critical voice and data information with other jurisdictions or disciplines. This inability to communicate threatens the safety and security of both responders and the population.

Apart from the importance of interoperable communications, there is a need to have the infrastructure coverage in place so that radio communications can support public safety and security requirements. While for most populated regions this may not be a problem, there may be regions where the existing radio tower infrastructure is inadequate to provide complete coverage.

A study has been conducted and identified radio coverage gap areas along the Canada-United States (US) border. To mitigate the operational impact of the gaps, current and emerging technology options were proposed as a means for supporting interoperability of communications that would be required to respond to multi-agency (national or cross-border) emergency management in these border regions.

The study has been performed by Martello Defence Security Consultants Inc. in partnership with Industry Canada's Communication Research Center (CRC). The funding and support for the study was provided by the Public Security Technical Program, under the Defence Research and Development Canada - Center for Security Science.

As a first step, first responder fixed voice radio stations along the Canada and United States border, including (Alaska-Yukon) were identified and the combined radio coverage was plotted to identify potential gaps in the area of interest which was a 30km wide band each side of the border (yellow-cyan on Figure 1). The data mining task was a significant level of effort through the selection and filtering of over 140,000 radio license records from the U.S. FCC's Universal Licensing System and Spectrum Direct from Canada.

A robust radio propagation software, which is free to use, "Radio Mobile for Windows", was modified as a batch program to run on a 1000+ CPU core supercomputer which allowed a continent-wide radio coverage plot at 100m/pixel resolution.

The radio propagation model results were validated through field testing and high fidelity fine-tuning measures were identified.

The main deliverables were high resolution coverage plots and associated tools and training for first responders that wish to maintain and update their "radio situation awareness".

The technology roadmap produced will help first responder and public safety agencies to plan and optimize their new system procurement with a common national approach.

New technology solution options were identified and presented as a technology roadmap including Technology Readiness Level (TRL) rating.

Impact
Should a significant incident occur in the border region, the radio coverage plots can be used as a repository to identify "who can talk to who" at the scene. This is a key enabler for interoperability of multi-agency on-scene response.
Coverage statistics were computed yielding an average geographic coverage for the border region while assuming all the radio systems were interoperable (for example: police can directly talk to fire, fire can talk directly to Coast Guard and all combinations thereof including EMS and other units).

As a final note, the following insights, based on best practices gleaned from this study, are offered to agencies relying on radio coverage:

1. You are responsible for your own radio coverage.
2. All your staff should be aware of the radio coverage and its limitations.
3. Test your coverage limits regularly by dispatching your staff for remote radio checks during quiet times. Do it from the car and from the handset, both have very different ranges.
4. Investigate "dead zones" and get your local radio supplier and installer to implement fixes.
5. Ensure your radio license reflects exactly what is deployed at your transmitter sites.
6. Do not rely on your cell phones; the lines will be busy if a significant event occurs.
7. Ensure you have a mobile repeater with a quick erecting tower that you can deploy.
8. Conduct interoperability exercises to ensure your radio channel plan works with other services. Do no assume the landline telephone network will work if a significant event takes place.
9. Have a few key personnel trained on the use of radio planning tools; ask for the help of your local amateur radio operators and your local FCC or Industry Canada representative.

10. Go for range, not for aesthetics on your vehicles. Long antennas (½ wave) are ugly and conspicuous but they give you range and best voice quality; give them the highest elevation real-estate on your vehicle. Insist for the best real-estate for your antennas on fixed towers, top mounted antennas are the best, side mounted antennas will be obstructed by the tower.

The full report for the Canada – United States Border Radio Coverage will be available in May 2011 for limited and controlled distribution. Requests are to be sent to Jack.Pagotto@drdc-rddc.gc.ca, Centre for Security Science, Defence R&D Canada.

> The Defence R&D Canada – Centre for Security Science is a joint endeavour between the Department of National Defence and Public Safety Canada to strengthen, through investments in science and technology, Canada's ability to prevent, prepare for, respond to, and recover from accidents, natural disasters, or terrorist and criminal acts that impact the safety and security of Canadians.

Captions

Figure 1 - Incident Scenario

Figure 2 - Continental-wide Coverage Plot Mosaic

Figure 3 - Field validation with CRC's instrumented trailer