REAL TIME CBRN SURVEILLANCE SYSTEM
DHS Working Together: R&D Partnerships in Homeland Security
Boston, MA April 27-28, 2005

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ABSTRACT

A Real Time Radiological Surveillance system has been implemented in networks comprised both mobile and static detectors. Data from radiation detectors specifically designed for counter terror applications is associated with location data (from Global Positioning System, WiFi-location system, or assigned for static) and is transmitted to central servers for transformation into the information required by emergency management Operation Centers. Meaningful graphic representations of the data are available in real time to static and mobile Command Centers. The system employs open architecture design, can additionally manage a wide variety of CBRN detectors to address multiple threat incidents and is scalable to large networks of hundreds of detectors. System alerting levels may be dynamically adjusted on the basis of changing intelligence information in order to balance threat agent detection sensitivity and costs of false positives.

BACKGROUND

Before 9/11, discussions of plausible terrorist actions generally discounted the use of radiological agents. This was largely because it was then believed that the primary objectives of terrorist attack would be achieved only through loss of life and, furthermore, radiological agents were then viewed to be inefficient with respect to inflicting loss of life. Post 9/11 analyses indicate that both of these assumptions are incorrect and counter terrorism security planning based on them is inadequate. Increasingly, official government media statements explicitly differentiate radiological agents from nuclear and other terrorist agents. Correspondingly, the public expectation for adequate counter terrorism security and response systems which encompass radiological agents has increased along with an emphasis on First Responder safety.

The malicious placement or the dispersal of radioactive material to attack symbolic, key infrastructure, population, economic and government targets are currently highly ranked emergency planning and exercise scenarios. Such terrorist actions may be undertaken overtly or covertly. Radiological agent risks have high potential for psychosocial impacts and consequently disrupting national or continental political and economic systems.

More specifically, recent actual terrorist activities indicate transportation operations and nodes to be specific terrorist targets. Additionally, transportation routes are employed for the illicit movement of radiological agents both within and between countries. Significant radiological sources can, in practice, be acquired through diversion or illegal purchase and moved undetected into target areas or through a transportation facility such as an air or ground passenger, baggage or cargo system. In addition, recent analyses have suggested that while much attention has been paid to the security and control of the public component of air travel, significant security gaps continue to exist in fixed-based aviation operations, i.e., the areas used for corporate, charter and pleasure aircraft.

Most symbolic and key infrastructure targets are not now equipped with redundant radiological sensors networked to provide real time radiological security status information to security operations, radiological experts, First Responders and decision makers. Should a radiological incident be merely alleged or actually occur, incident management by Operations Centers is currently constrained by a lack of consistent, reliable, prompt data available as information in a format suitable for use and interpretation by emergency management. Anticipated terrorist targets are now at unacceptable risk should a radiological incident occur or be alleged.

CANADA AND CRTI

As a component of its response to emergent terrorist threats, the Canadian Department of National Defence put in place the CBRN Research Technology Initiative (CRTI) [1] with funding initiatives including a mobile radiological surveillance network operating in real time in Royal Canadian Mounted Police vehicles in the Ottawa National Capital Region [2] and, more recently, a mixed static and mobile radiological surveillance system in the Ottawa International Airport [3].

A key feature of the CRTI funding initiative is the inclusion of Project Partners with both technological and scientific expertise as well as Partners with operational expertise and responsibilities. As a result, the system designs are developed to meet the explicit needs of security, enforcement and response agencies and to mesh with their pre-existing operational practices and procedures.

Two CRTI Projects integrate currently available radiation detection, position determination, telecommunications, micro computer, and information visualization technologies to build a radiological surveillance system specifically suitable to address the counter terrorism environment. As such, the resulting systems are a departure from other approaches oriented toward supporting earlier designs of traditional health physics instrumentation.

SYSTEM OVERVIEW

Radiation and Other Sensors

Ruggedized scintillation gamma detectors have been adapted to counter terrorism applications with temperature, acceleration and vibration and electromagnetic tolerance. Both low and high energy spectral capabilities are provided for with scintillation material options. Sensitivity and lower limits of differentiation from expected geo-location specific background radiation levels are trade offs with detector weight and volume in specific applications.

Scintillation detector technology provides for the cost effective screening of common radiopharmasecuticals and the identification of the most probable illicit radiological agents [4]. Open architecture systems design provides the flexibility to support CBRN detectors from other manufacturers as well as hardware and software subsystems already in use such as telecommunications, encryption, data bases, etc.

Detection Units

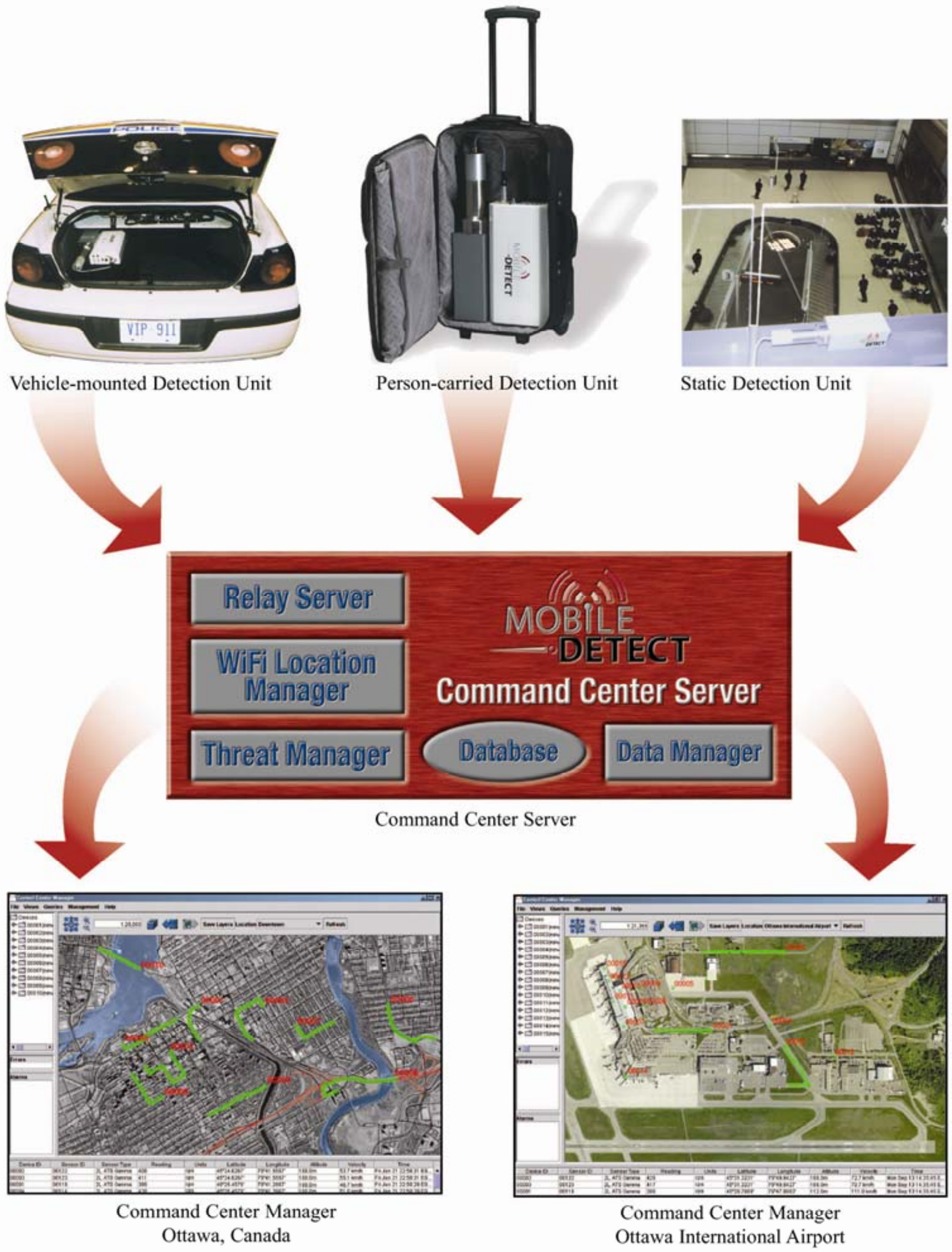
Detection Units provide sensor management by supporting requirements for power and bidirectional communication of commands and data. Three RS232 ports are available for external devices including any RS232 capable sensors.

The Mobile deployed Detection Units include Global Positioning System functionality on board. Other positioning systems, such as WiFi-based technologies, are optionally supported.

The Detection Units include wide area modems compatible with GSM/GPRS networks. Other telecommunications systems including secure Ethernet, WiFi, and secure networks are optionally supported. Data encryption is provided and user specific encryption requirements are supported as options.

Detection Unit on-board processing associates sensor output data with positioning data and stores the resulting data sets in local memory. Data may be transmitted on a time scale commensurate with the sensor integration time or stored and batch transmitted on user defined or

CBRN SURVEILLANCE NETWORK



alarm determined schedules. Data is stored locally if telecommunications are lost and subsequently transmitted.

Detection Units optionally communicate with local alarming systems and operate local audio and visual alarms. Alarm activation can be under local autonomous Detection Unit control and based on sensor data or under remote central Operations Center control. Alarm functionality is provided for both caution and turn around hazard levels, as are established in some jurisdictions.

Command Center Server

A central server based system Control Center Server manages the transmission and receipt of both commands and data to and from the Detection Units in the system. Radiation or other sensor data are stored in a data base and analyzed with threat levels. Alarming options for Operations Center monitoring system alerts, key personnel paging, etc. are available.

Since intelligence sources may indicate lower or higher levels of the risk of attack, the system provides for dynamic adjustment of the alert threshold levels. Lower risk levels may then lead to higher alert threshold levels and correspondingly lower costs of false positives. Conversely, higher risk levels dictate the acceptance of the cost of higher false positive rates and thus lower alert threshold levels.

Command Center Manager

Control Center Managers provide for access to real time radiation and other sensor data and to data base data. Control Center Managers may be both static, e.g., Operations Center, or mobile Command Center based. Visualization facilities allow the overlay of radiation data on mapping tools for situation overviews. Data may be viewed in real time or data may be extracted from the data base for replay of incident developments or for assessment of mapped radiation levels.

SYSTEM OPERATION

The system provides for autonomous operation on a 24/7 basis without operator intervention. This reduces requirements for operator training for field surveillance units and allows for reliance on centralized interpretation of field data by a smaller number of qualified experts. A particular advantage is the consistent and reliable reporting of field radiation measurement data even under conditions stressful for human operators.

Although the two current systems have twenty-five radiation sensor units, systems may be scaled to support hundred of units per appropriately configured Control Center server and telecommunications system.

The long term operation of a radiological surveillance system, in the absence of actual radiological incidents, leads to a characterization of the normal radiation measurements to be encountered and a detailed understanding of the expected radiological environment of the area under surveillance. In any radiological environment, significant variability due to geo-location, building materials, season, meteorology, and the presence of licit radiation sources such as medical outpatients leads to variability over one order of magnitude.

Knowledge of the expected radiological environment with geo-location and associated other data leads in turn to improved threat analysis by the Command Center Server, and management of false positive measurements and to lower limits of detection.

Following any actual or alleged incident, knowledge of baseline radiation levels and their variability will be important in addressing remediation requirements. This knowledge will also be essential in addressing public and media concerns.

Incident site management tools can now be based on the availability of mobile surveillance and rapidly redeployable surveillance radiation survey assets. This allows monitoring of the development of an incident in real time with advantages such as monitoring of safe zone boundaries. Forensic data is available from data base records.

Security is increasingly based on covert operations. Some key infrastructure facilities allocate up to one third of resources to covert surveillance. The autonomous system operation of measurement, location identification and data transmission taken together with small volumes and weights lend themselves to covert person carried surveillance tools.

FURTHER APPLICATIONS

Brief mention has been made of the utility of the system in the transportation sector. Given 9/11 and the imaginative adoption by terrorists of common-use technologies to achieve their aims, it is essential that future counter-terror strategies must be equally imaginative. Potential targets include, but are not limited to: health care facilities; critical media production or transmission facilities; large scale public events such as sporting or political gatherings; and strategic, economic, political or military targets. All of these targets now require a defence-in-depth approach which must include the ability to continuously and automatically detect radiological and other CBRN terror agents.

REFERENCES

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