

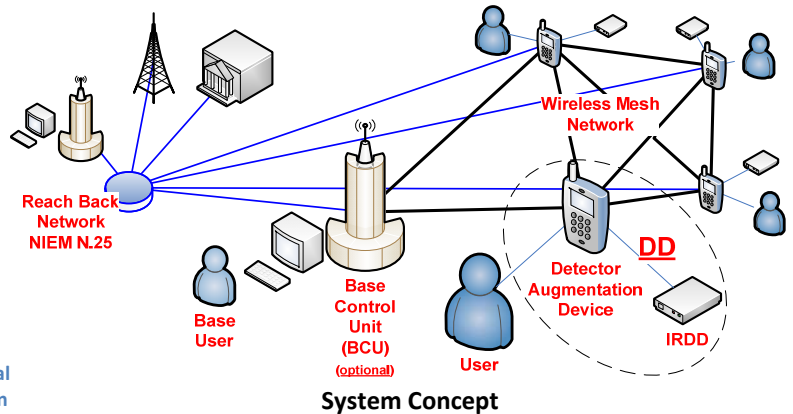
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Abstract

In response to the Domestic Nuclear Detection Office's (DNDO) BAA 09-102 Passport Systems, Inc. of Billerica, MA has carried out a system-level trade space study and started development of a networked system of Intelligent Personal Radiation Locators (IPRLs) and Human Portable Radiation Detection Systems (HPRDSs) designed to improve the detection, localization, and identification of potential radiological threats. A system of this nature is targeted to situations where it is not feasible to direct traffic through portal radiation detection systems, e.g. large events, search team objectives, etc. The networking of individual portable detectors combined with advanced algorithms has been shown within this program to significantly increase the effectiveness and sensitivity of the system to map NORM (naturally occurring radioactive material) backgrounds and to localize radiological sources.

Introduction

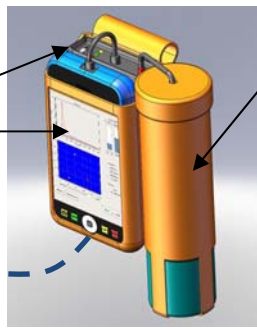
The IRSS ATD program objective is to develop and demonstrate a cost effective networked system of personal radiation monitors. A potential system would be useful to first responders, HAZMAT teams, search units, etc. for detecting, localizing, and identifying potential radiological hazards and/or threats in unconstrained environments where portal monitoring is not possible. The system design uses COTS and OEM hardware and employs network-based advanced algorithms to fully utilize data. System performance depends on precise detector localization for accurate fusion of network data.



Detector Augmentation Device (DAD)

- Standard Interface
- Smart Phone (including GPS)

Inertial Navigation Unit (INU)



Individual Radiation Detection Device (IRDD)

System Concept

Advanced Algorithms

Focus of this work is to develop new algorithms that make maximal use of the fused data from a network of standard integrated system components. Program objective is to define the network's value added through intelligent exploitation of the data.

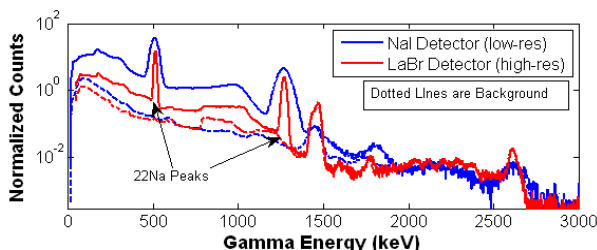
Key features of the work include:

- Develop both analytic and probabilistic detection and localization estimation algorithms based on corporate expertise in data fusion methods and analysis
- Design a network based system to independently track and evaluate background levels to provide low false alarm rates
- Uses maximum-likelihood estimation algorithms for source detection and localization to take full advantage of sparse, low-level data
- Develop a wide range of identification algorithms to operate at various levels of spectral fidelity

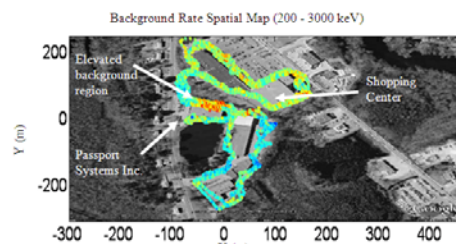
System Integration

The hardware integration concept has two primary drivers: 1) Use of commercially available components, and 2) Modular design for easy integration and upgrade.

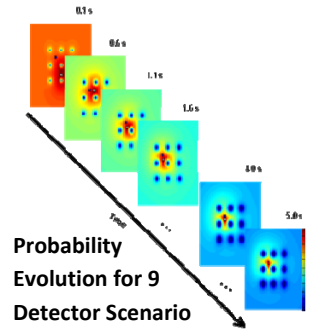
- Designing a sensor adjunct (Detector Augmentation Device – DAD) to provide ubiquitous interface to any detector
- Sensor (IRDD) performance trade space well understood based on corporate expertise in radiation detection
- Implementing standard communication and network protocols
- Leveraging “smart phones” for computation and communications
- **Utilizes integrated differential GPS when possible; Will require an INU unit for GPS denied environments**



Sample ²²Na Radiation Spectra for Different Detectors



Radiation Background Map of Local Area



Probability Evolution for 9 Detector Scenario

Conclusion

Passport Systems, Inc. is currently working toward a Critical Design Review (CDR) for an Intelligent Radiation Sensor System (IRSS) in support of an Advanced Technology Demonstration (ATD) for DNDO. To date the viability of COTS/OEM components to support this work has been shown – **although localization hardware has not been finalized** – and the advanced algorithms required to enable detection, localization, and identification of radiological threats by a networked system have been developed and continue to be refined.

This work is being performed for the U.S. Department of Homeland Security Domestic Nuclear Detection Office (DNDO) in response to BAA 09-102.