



Radiation Detection Instrumentation





Three Step Process for Radiological Response



Detection, identification and recovery of a radiation source

Step 1

**Survey, Detection,
Localization
and Pinpointing**

Radiation Pager

Linear Radiation Monitor

Radiation Backpack

SPARCS Mobile System



Step 2

**Screening and
Identification**

Radioisotope Identifier
(RIID)

High Resolution RIID



Step 3

Recovery

Tele-probe

Health Physics Kit



Radiation Pager



Personal Radiation Detector (PRD) primarily for routine monitoring, detection, localization and pinpointing radioactive materials





Radiation Pager Display

*Primarily a search tool
(i.e. not a dosimeter for safety)*

LED display shows alarm level. Two modes - audio and vibration

Alarm levels (0-9):

*Less than 9 = safe
(9 or greater move away and report)*

Update button resets background to current level extending range of unit



Alarm Level vs Dose Rate

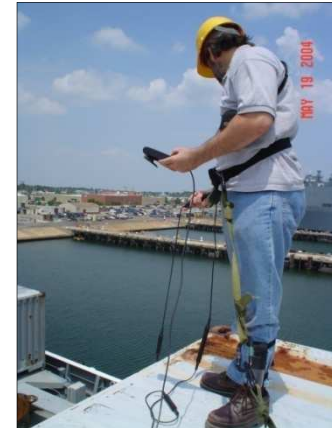
0 =	bkg	0.01 $\mu\text{Sv/h}$
1 =	2x bkg	0.02 $\mu\text{Sv/h}$
2 =	4x bkg	0.04 $\mu\text{Sv/h}$
3 =	8x bkg	0.08 $\mu\text{Sv/h}$
4 =	16x bkg	0.16 $\mu\text{Sv/h}$
.....		
.....		
8 =	256x bkg	2.56 $\mu\text{Sv/h}$
9 =	512x bkg	5.12 $\mu\text{Sv/h}$



Linear Radiation Monitor (LRM)



80 foot cable with gamma sensors for portal monitoring or bundled for high sensitivity backpack search tool





LRM Monitor Alarm Display



Bar chart showing the relative count rates in the 18 individual gamma detectors

In the backpack mode, all 18 detectors are summed together to make one large, high sensitivity detector





Backpack Radiation Detector



Dual gamma and neutron detector for survey/search of radioactive materials, high sensitivity portable system

30 times more sensitive than pager or RIID





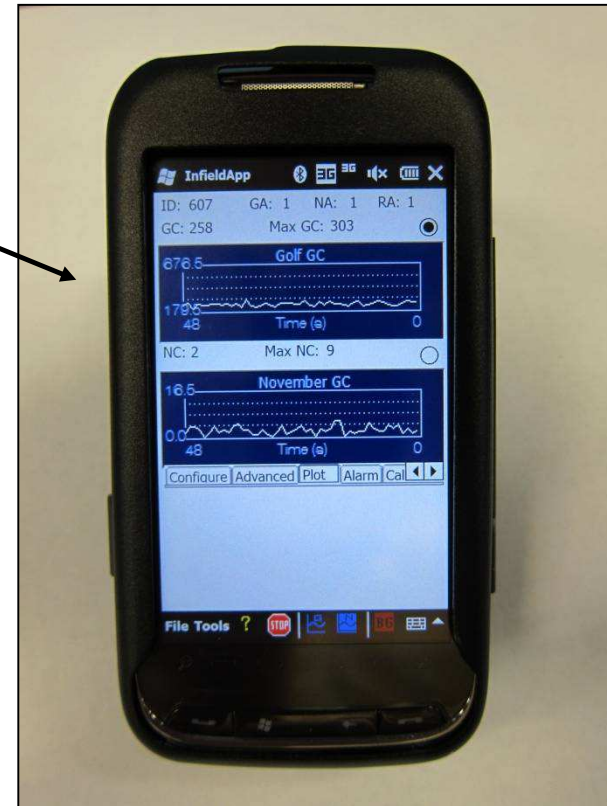
Backpack Radiation Detector Alarm Display



Smart phone showing the gamma and neutron strip charts, count rates and alarm levels

The visual strip chart can be used to monitor the highest count rate which is a direct indication of the closest approach to either a gamma or neutron radiation source

Alarm levels are based on the number of standard deviations above the background count rate





System Start-Up and Alarm Voice Messages



*Infield Search System XXX (serial number),
collecting background, please wait*

The unit will turn on the detector high voltages, stabilize electronics and collect a 120 second background (total set up time < 3 minutes).

Background complete, normal search mode

System starts up in Dynamic Mode and ready for search operations.

Alarms

Golf 4, 5, 6..... (for gamma)

November 4, 5, 6..... (for neutron)





Operator Switch and Voice Messages



Press 1 second – system check, status ok

Press 3 seconds – background update

There are two modes of operation (Dynamic Mode with 3 seconds collection time and Delta Rate Mode with 0.5 second collection time)

Press >5 seconds – switch to Delta Rate Mode (Locate Mode)

Press >5 seconds a second time to return to Dynamic Mode (Normal Search Mode)



Operator Switch



SPARCS



***SP**ectral **Ad**vanced **R**adiological **C**omputer **S**ystem*

Modular, readily deployable system for gamma detection at temporary portals such as border crossings. Data is correlated with GPS coordinates. Rapidly installed in vehicles, boats or aircraft.



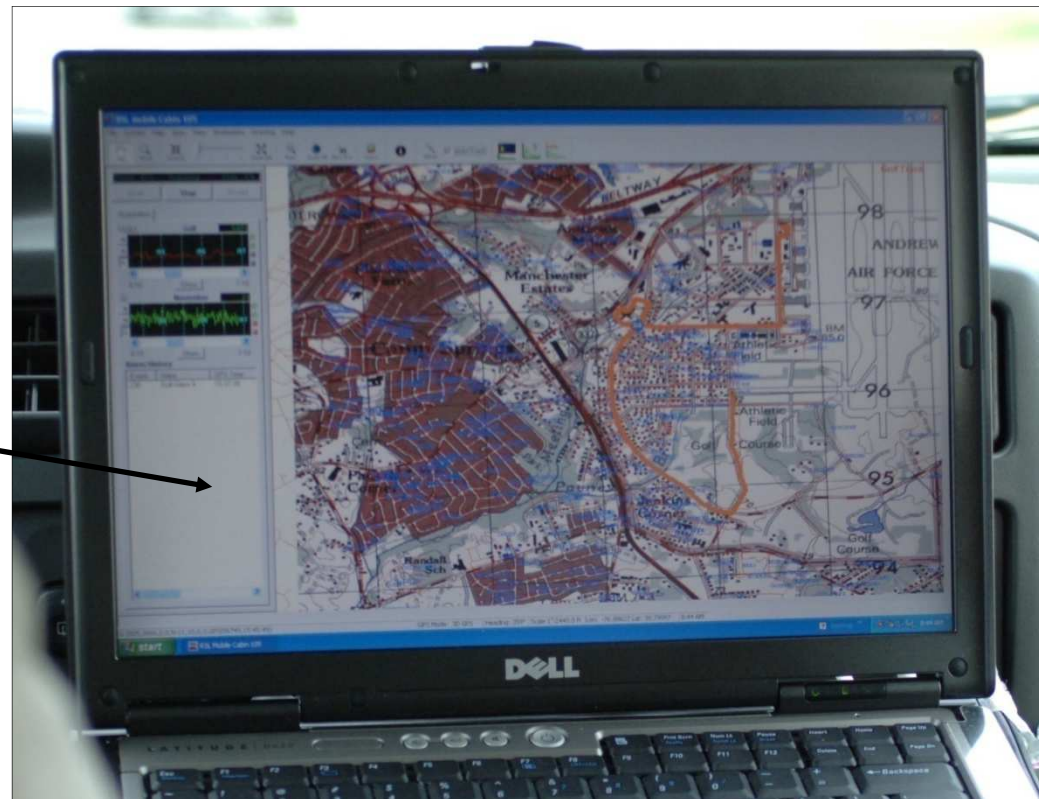


SPARCS Laptop Display



Graphical display
showing GPS map
overlay, alarm levels
and count rate strip
charts

Real time identification
of common radioisotopes,
spectral acquisition and
email to experts for advice

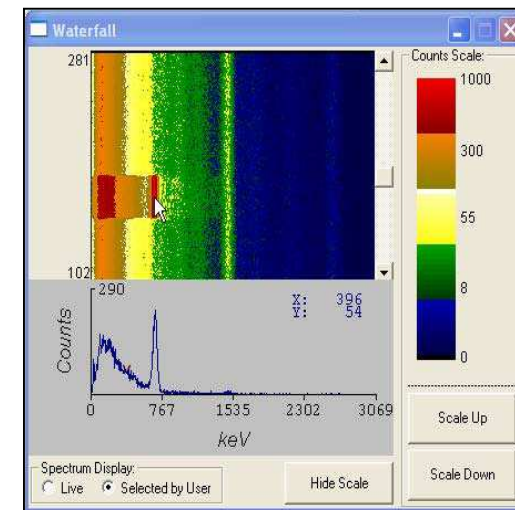




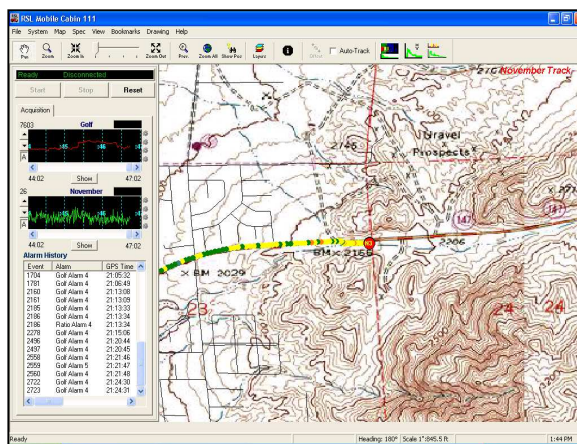
Display Options



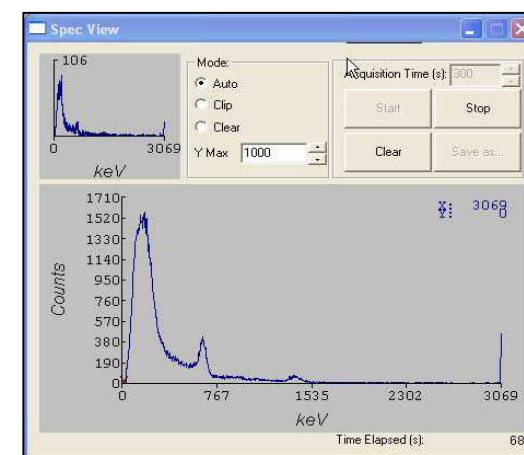
Strip Charts



Waterfall Chart



Street Map/Aerial Photo Overlay



Gamma Spectrum



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Tele-probe

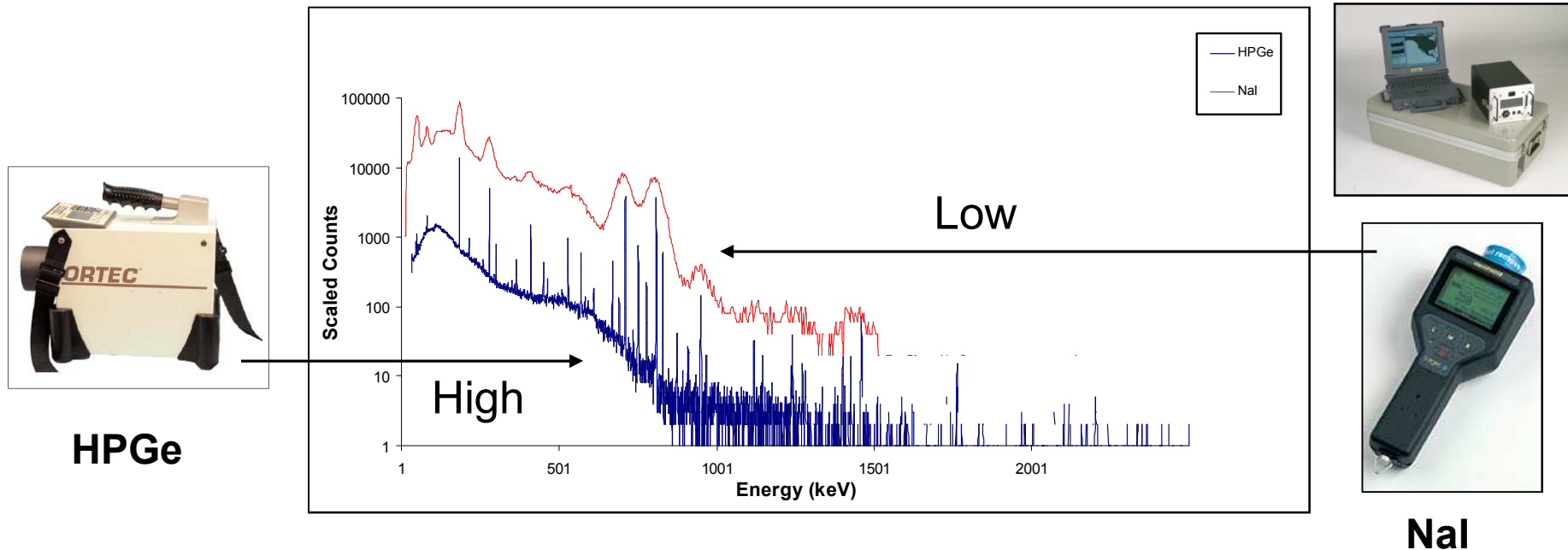
Health Physics Kit



Radioactive Material Identification

High Resolution versus Low Resolution Gamma Spectroscopy

“ability to resolve adjacent gamma peaks”



Comparison of a sodium iodide spectrum (low resolution) to a high purity germanium spectrum (high resolution)



Radiol**is**otope **ID**entifier (RIID)



Low resolution sodium iodide gamma detector for initial **screening** of radioactive materials, small neutron detector





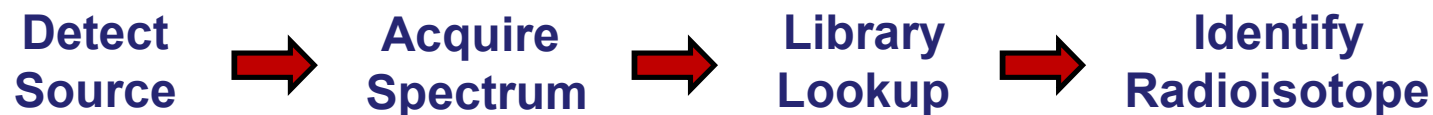
Radioisotope Identifier Display

Display showing preliminary isotope identification

Screening with a RIID is the first step to identifying the radiation source and includes comparing results with cargo manifest and consulting experts for guidance



Four Step Process





Radionuclide Identification (High Resolution RIID)



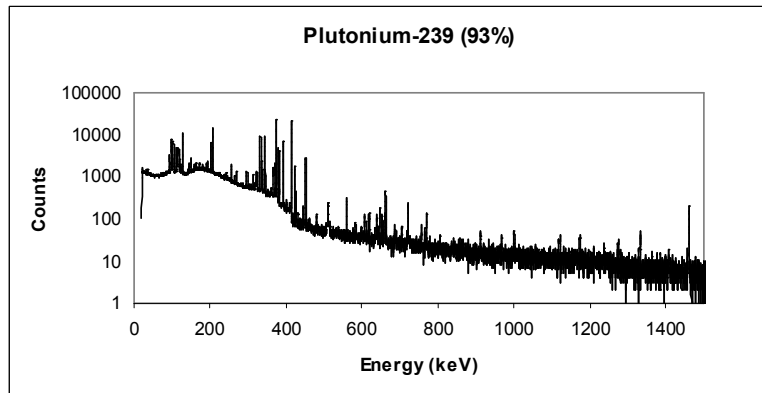
High resolution High Purity
Germanium gamma detector *for
laboratory quality spectroscopy
in the field* and accurate
radioactive material identification





Radionuclide ID Display

Display showing gamma spectrum and count rates



Every radioisotope has a unique spectral fingerprint

Three Step Process



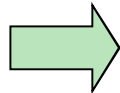


Phased Approach

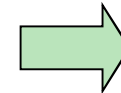
Radiation Search



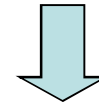
Wide Area Search



Small Area Search



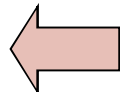
Localization/Pinpointing



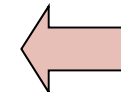
Radioisotope Identification



Data Analysis



Identification



Screening



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Tele-Probe Detector

Extendable long probe for measuring dose rates

FH-40 Tele-probe

Extendible up to 4 meters

Detectors

Proportional tube (internal)

Can be used with several probes

Unit Dimensions

0.4 kg

20 cm L x 7 cm W x 4 cm H

Uses

Measure dose rates





Health Physics Kit

Calibrated instrument for measuring dose and contamination

Internal Geiger-Muller detectors

- Two separate detectors
- Low dose and high dose
- Beta window on low range detector



Pancake probe (beta/gamma)

- Geiger-Muller detector

Alpha probe

- Zinc sulfide scintillation detector
- Mylar window
- 100 cm² surface





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Questions?



Detection, Identification, Recovery