

Intelligent, Modular Solutions for Nuclear and Radiological Material Detection, Identification and Mapping



The Detective-Mobile Nuclide Search and Identification System

Introduction

ORTEC Detective and Micro-Detective hand-held high purity germanium (HPGe) radioisotope identifiers (RIIDs) continue to be widely used around the world by security agents and customs operatives, 24 hours of every day in their hundreds. They are found in the front line of the fight against illicit trafficking of nuclear materials, where their performance is now well known, in terms of "getting it right first time": low false positives and low false negatives.

The ORTEC Detective-ASP Modular spectroscopic portal monitor employs the same now well-proven algorithms in large-scale monitoring of traffic flows through vehicle and pedestrian portals. The combination of ORTEC HPGe detection technology and the Detective ID algorithms simply cannot be beaten in a passive monitor.

And now, in the form of the Detective-Mobile, this same technology is brought to applications requiring searching for and identification of nuclides from a moving vehicle in the form of an application software package. **For the first time it is possible to bring the superior selectivity of the HPGe detector and ORTEC advanced algorithms to bear on this class of detection problems.**

Detective-Mobile

Detective-Mobile offers state-of-the-art **real-time** radionuclide detection and **real-time nuclide identification** for Homeland Security applications from a simple-to-operate user interface with intuitive GPS mapping. It provides unambiguous results in "drive-by" or "fly-by" modes. It is also useful in certain stationary situations.

The over-all system is configurable from existing Detective RIID or ASP detector hardware,¹ or can be supplied as a purpose-built integrated system, either approach offering huge flexibility and enhanced value.

Whatever your detection requirements, a Detective-Mobile System can be optimally configured for land, sea, or air search operations.

Detective-Mobile Application Software

GE-SS-B32

Analysis Software Features

- Software layout is intuitive and simple to learn.
- Effectively combines the data from multiple detectors for the most sensitive and accurate detection and identifications.
- Searches in energy, time, and position for the highest possibility of detection of point source and distributed sources.
- Uses the optimum combination of data to get the most sensitive results in real time.
 - Analysis Approach:
 - Multiple sliding windows examine 1 second slices of data in groups of 8, 30, 60, and 120 seconds simultaneously.
 - Detector data results are tried in different combinations to optimize sensitivity.
 - Up to 32 different analysis passes for each analysis result point.
 - Typically one analysis result point is posted every 1 to 2 seconds.
- Data Record for each measurement point contains:
 - Identified source(s) list.
 - Time and location.
 - Threat and Signal indices.
 - Spectroscopic data.
 - Gamma ray (and optional neutron²) gross count rate data.
- Built on software platforms from industry leaders including ESRI ArcGIS 9.3.1³ mapping software and Microsoft SQL Server 2008 database server. (Access to hundreds of maps world wide.)

Detective-Mobile in Use, the Simple Operator Interface

The Detective-Mobile system is easy to use with minimal training required. The system automatically begins collecting data and analyzing information in real time. If an alarm limit is exceeded, an alarm notification occurs and the Map Display is updated with the alarm marker, placed based on the GPS position, and showing the alarm condition. By moving the mouse cursor over the event data point, threat data is automatically displayed. All alarms must be acknowledged or they will persist.

Interactive Map Display

The map displays individual GPS locations or “breadcrumbs” that represent the vehicle location for each second of system operation. (Figure 1.) Point data includes date, time, count rates, the highest threat, and any source identifications. Threat alarms, such as the Am-241 alarm in the lower left of Figure 1 must be acknowledged by the operator or they will persist.

The measurements tab is shown in Figure 2. The data are presented as a scrolling temporal record, with the nuclide identifications shown in the right hand column.

¹The IDM “Interchangeable Detector Module,” with all in one 85 mm HPGe detector, digital electronics and Stirling cycle cooler.

<http://www.ortec-online.com/download.aspx?AttributeFileId=44358d3a-9d73-4a4b-9937-f3a734173010>

²Helium-3 neutron detectors currently have restricted availability. Please contact your ORTEC representative to determine their availability for your application before placing an order.

³ESRI is the world leader in mapping software. Support and training services are available. For more information on ESRI and ArcGIS, visit these links: <http://www.esri.com/products/index.html> and <http://www.esri.com/library/brochures/pdfs/arcgis.pdf>.

Threat and Signal Indexes and Long Count Mode

In both Figures 1 and 2, the lower part of the display shows “Threat” and “Signal” Indices in order to alert the operator to changes in the gamma-ray flux below the alarm level that might otherwise go unnoticed in a survey.

The Threat Index is an indication of the current highest peak confidence level currently occurring for any of the nuclides designated as “threat” in the table of nuclides. The Signal Index is similar, but count-rate related. A raised Threat or Signal Index indicates where stationary measurements or further investigations should be performed. Long Count Mode allows intensive stationary analysis in suspicious locations without sliding window averaging.

Figure 1. Map Display (simulated data).

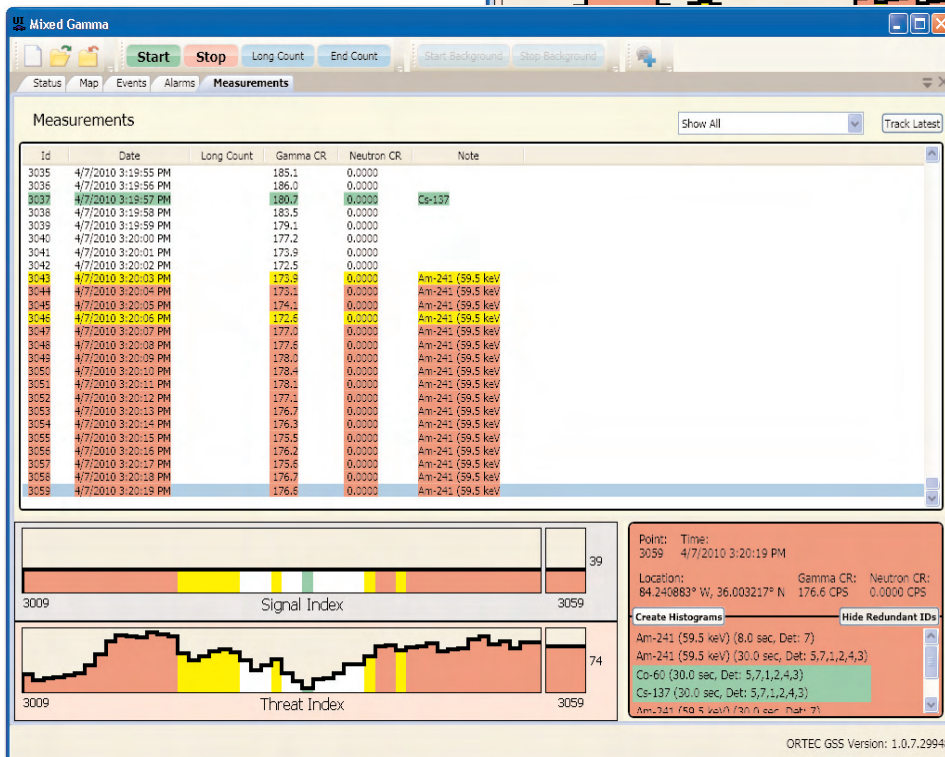
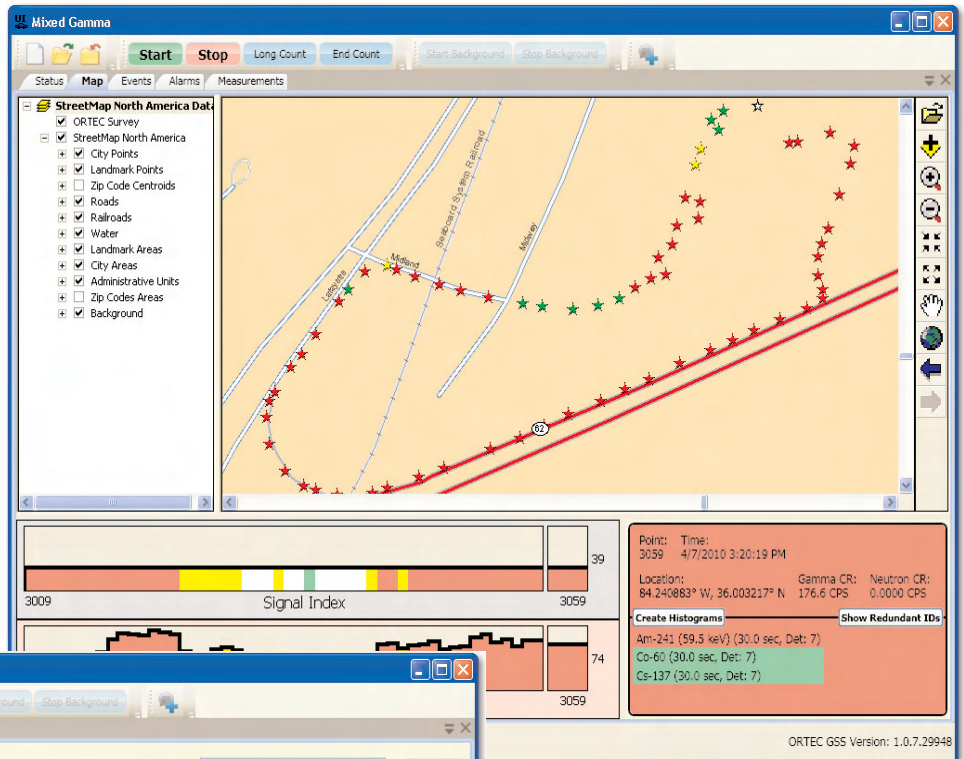


Figure 2. Measurements Display.

Detective-Mobile Application Software

GE-SS-B32

Spectral Displays

The “create histograms on screen” button (Figures 1 and 2) creates an ORTEC “CHN” spectrum file from the selected data points which may then be displayed using the familiar MAESTRO-32 MCA software. The point of interest is selected and then the integration periods are selected as 8, 30, 60 or 120 seconds, the integral being centred around the selected data point.

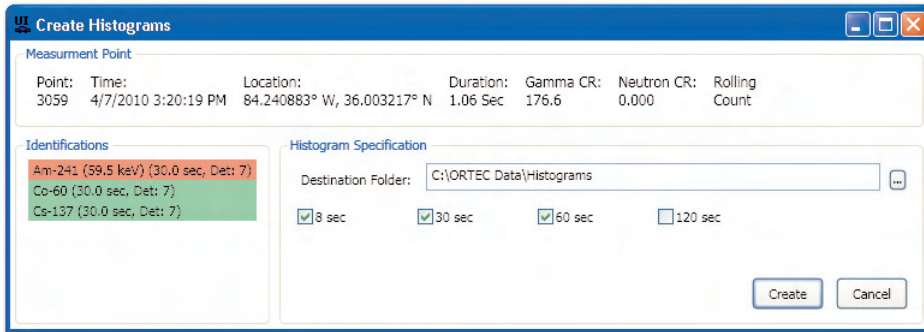


Figure 3. Create Histograms Dialog.

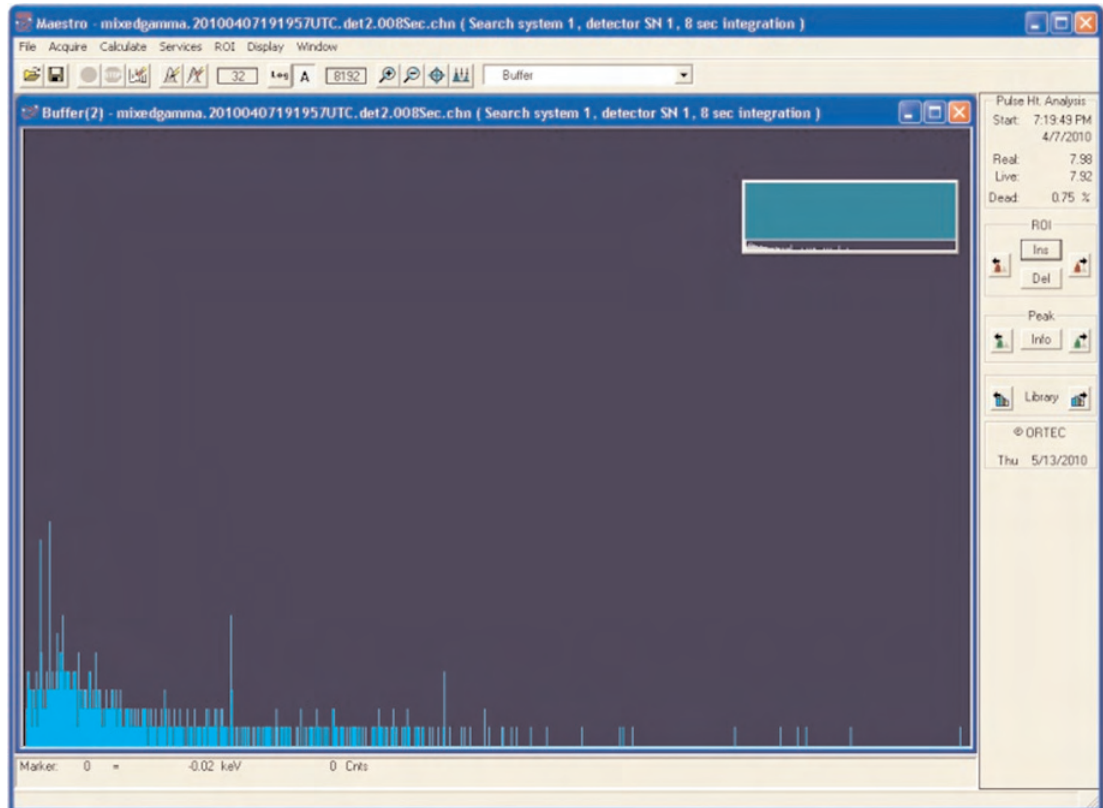


Figure 4. 8-Second Spectrum Display of Data Selected by Figures 2 and 3.

Detective-Mobile Nuclide Identification List

THREAT	INNOCENT	INNOCENT	INNOCENT	INNOCENT	INNOCENT	INNOCENT
HEU	Ac-225	Cf-252/Cf-249	Ga-64 (shielded)	Ir-192 (shielded)	Pd-103	Tc-99M
Enriched Uranium	Ac-227	Cm-243	Ga-67	Os-194/Ir-194	Rh-105	Te-132
U-235	Ag-110m	Cm-244	Ge-68/Ga-68	Ir-194 (shielded)	Ru-97	Tl-201
Pu-239	Ar-41	Co-56	Gd-153	K-40	Ru-106/Rh-106	Tl-200
Np-237	As-72	Co-56 (shielded)	Gd-159	Kr-87	Po-210	Tl-202
U-233	As-74	Co-55	Hf-181	Kr-88	Pr-144	Tl-204
U-238	At-211	Co-57	Hg-203	Kr-88 (shielded)	Ra-223	Th-229
U-232	Au-198	Co-58	Ho-166m	La-140	Ra-226	Th-230
Am-241	Ba-133	Co-60	Ho-166m (shielded)	Lu-172	Ru-103	Th-232
Am-241 (shielded)	Ba-140	Cr-51	Ho-166	Lu-176	Sb-124	Tm-170
Am-241 (59.5 keV)	Be-7	Cs-131	I-123	Lu-177	Sb-124 (shielded)	Tm-171
	Bi-207	Cs-134	I-123 (shielded)	Lu-177M	Sb-125	U-232/Th-232
	Bi-212 (Th232/U232 daughter)	Cs-137	I-124	Mn-52	Sb-127	W-188/Re-188
	Bi-214 (Ra226 daughter)	Cu-64	I-125	Mn-54	Sc-46	Xe-127
	Br-76	Cu-67/Ga-67	I-126	Mn-56	Se-75	Xe-133
	Br-76 (shielded)	Eu-152	I-126 (shielded)	Mo-99	Sm-153	Xe-131M
	Br-76 (heavily shielded)	Eu-154	I-131	Na-22	Sm-153 (shielded)	Xe-135
	Br-77	Eu-155	I-131 (shielded)	Na-24	Sn-113	Y-88
	Ca-47	Eu-156	I-132	Nb-94	Sr-82/Rb-82	Y-91
	Cd-109	F-18	I-133	Nb-95	Sr-85	Yb-169
	Cd-115	Neutrons on Fe	I-134	Nb-96 (shielded)	Sr-89	Zn-65
	Cd-139	Fe-59	I-135	Nd-147	Sr-90/Sr-89/Y-90	Zn-62
	Cd-141	Elevated radiation or beta emitter	In-111	Pa-231	Ta-182	Zr-95
	Cd-144	Ga-64	Ir-192	Pb-203	Tc-96	

Detective-Mobile Application Software

GE-SS-B32

Detective-Mobile Architecture

The Detective-Mobile software application is the heart of any Detective-Mobile Radiation Search System. It can be used by system integrators and end users comfortable with networking basics, or ORTEC can supply a complete turn-key system ready to go to work.

A working Detective-Mobile Radiation Search System comprises at least a single, high-performance laptop PC with GPS which is connected via a TCPIP network (generally wireless) to one or more “detector nodes.”

Detector Nodes

The definition of a “detector node” is important in this context. The node is intelligent and acts as a data concentrator, running a “sub-application” to serve the processed data back to the host computer across the network. Because of the high performance data processor already built into the Micro-Detective models, this sub-application can run on the instrument itself. All other models (Detective, Detective-EX/DX, and IDM) require a “server” between the instrument and the host PC. This server is implemented by the use of the TDS NOMAD High Performance Data Collector (see <http://www.tdsway.com/products/nomad>).

Flexible Configuration Capability

The Detective-Mobile system can be configured with up to 8 detector nodes in any combination. A system can be readily reconfigured from available equipment to meet the mission requirements for maximum sensitivity, compactness, etc. System sensitivity is limited only by the available inventory of compatible devices from which to configure detector nodes.

A valuable feature is the ability to remove one or more Detectives from a vehicle-borne system to localize the threat source by team members on foot. Since the system is usually wirelessly connected, this can be as simple as picking up a unit and leaving the vehicle to search more carefully. Detectives carried by incident team members can transmit data back to the vehicle-borne laptop.

While the minimal system may be completely installed on a single host PC, an alternative configuration is one in which a single analysis PC is networked to one or more PCs running the user interface (UI) program. This means, for example, that out-of-vehicle team members could monitor the progress of the search on tablet PCs.

Instrument	Node Additional Requirement
Micro-Detective	Install Software
Micro-Detective-HX	Install Software
Detective	TDS Data Collector plus software
Detective-EX/DX	TDS Data Collector plus software
IDM	TDS Data Collector plus software



Figure 5. Simplest configuration, one Micro-Detective acts as a single node. Single laptop acts as user interface and analysis computer.



Figure 6. General configuration, multiple detector nodes and separate user interface and analysis computers.

“Ad-hoc” Stationary Applications

Extra-ordinary Situations Often Call for Creative Thinking:

In an emergency response situation, very little is guaranteed other than the fact that the “plan” will have to be adapted to suit the reality. Measurement problems which were not predicted may have to be addressed with whatever equipment is available “right here, right now.” In that regard, the Detective-Mobile excels:

- Detector nodes in a Detective-Mobile Search System may be setup using any Detective RIIDs, meaning they can be detached for other uses such as close scrutiny INSIDE a vehicle.
- The measurement display (Figure 2) is a time-based display. It operates whether or not the system is moving. A group of detector nodes is easily arranged in a vertical pillar inside a parked van, in which case the system can constitute an ad-hoc one- or even two-sided portal monitor which might be used to monitor crowds passing on their way into a public event.
- The Long Count Mode, in which there is no scrolling of data, could be used as an ad-hoc contamination monitor for screening personnel in the event of a nuclear terrorism incident such as a RDD.

Detective-Mobile Software and Hardware Requirements

The following components are required to assemble an ORTEC Detective-Mobile Search System

- From 1 to 8 detector nodes (Table 1) with GE-SS-DETUG software installed. (This software includes components for installation on any of the node configurations listed.) The TDS NOMAD high performance data collector is available from TRIPOD Data Systems: <http://www.tdsweb.com/products/nomad>.
- Either of the following computer configurations:

Note: The search system application is a computer-intensive application and the following specifications should be regarded as minimum. Higher specification computers are strongly encouraged for optimum performance.

Single computer configuration: Minimum 3 GB memory, 2 GHz Core-2 Duo processor or better, discrete DirectX 9 compatible or higher, video subsystem (no shared memory with CPU), minimum 1024x768 display, 60 GB hard disk, DVD-ROM drive, Windows XP Pro (x86).

Two or more computer configuration:

Analysis computer (one required): Minimum 3 GB memory, 2 GHz Core-2 Duo processor or better, 60 GB hard disk, DVD-ROM drive, Windows XP Pro (x86).

User Interface computer(s): One or more, each with minimum 2 GB memory, 2 GHz Core-2 Duo processor or better, 20 GB hard disk, DVD-ROM drive, discrete DirectX 9 compatible or higher, video subsystem (no shared memory with CPU), minimum 1024x768 display, Windows XP Pro (x86).

- A valid TCP/IP network that connects all of the computers and detector nodes, either wireless or partially wired with wireless router for detector nodes.
- GPS: DELORME LT40 or equivalent.
- ESRI Single Use ArcView Version 9.3.1, or later, Desktop GIS package (ORTEC Part Number 931485).
- Microsoft SQL Server 2008 Workgroup Edition with SP1 and 5 client licenses (ORTEC Part Number 934074).
- GE-SS-B32 ORTEC Germanium Search System Application Software. Includes GE-SS user interface software, GE-SS analysis software and A65-B32 MAESTRO-32 software. Software is provided on CD with operator manual, administrator manual, and configuration guide.
- If a “more than two” computer configuration is required in which there are to be multiple user interface computers, each additional user interface computer beyond the first requires:
GE-SS-N32 ORTEC Germanium Search System Application Software Network copy. (Additional copy of ArcView software required.)

Detective-Mobile Application Software

GE-SS-B32

Ordering Information

Complete integrated Detective-Mobile Search Systems, including all mounting hardware and vehicles are available from ORTEC. If that is your requirement please contact your local agent. Otherwise a system may be built as follows:

Host Computer

Model	Description
GE-SS-SK-1	Detective-Mobile Single Computer Starter Kit. Includes: GE-SS-B32 ORTEC Germanium Search System Application Software Delorme LT40 GPS PC-GE-SS-0 Laptop computer meeting single computer requirements above ESRI Single Use ArcView Version 9.3.1 or later Desktop GIS package (ORTEC Part Number 931485) Microsoft SQL Server 2008 Workgroup Edition w/SP1 and 5 client licenses (ORTEC Part Number 934074).
GE-SS-SK-2	Detective-Mobile Two Computer Starter Kit. Includes: GE-SS-B32 ORTEC Germanium Search System Application Software Delorme LT40 GPS PC-GE-SS-1 Computer meeting Analysis Computer requirements above PC-GE-SS-2 Computer meeting User Interface Computer requirements above ESRI Single Use ArcView Version 9.3.1 or later Desktop GIS package (ORTEC Part Number 931485) Microsoft SQL Server 2008 Workgroup Edition w/SP1 and 5 client licenses (ORTEC Part Number 934074).

Node(s) (At least one required)

Model	Description
For use with Micro-Detective and Micro-Detective-HX (instruments not included).	
GE-SS-DETUG	GE-SS Firmware and software upgrade Kit.

For use with Detective and Detective-EX/DX models and IDM (instruments not included).

GE-SS-SRV	Server subsystem for connection GE-SS-SK-1. Includes TDS Nomad with software and all cables needed to connect one Detective, Detective-100, Detective-EX, Detective-EX-100, Detective-DX, Detective-DX-100, or IDM.
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Add More Value to Your Classic Detective or Micro-Detective By Upgrading!

Any Detective, Detective-100, Detective-EX, Detective-EX-100, Detective-DX, or Detective-DX-100 can be upgraded to the latest high performance computing ability of the Micro-Detective or Micro-Detective-HX. This upgrade will ensure your instrument is up-to-date with the most recent performance and reliability improvements and remove the need for the additional data concentrator. After upgrading your instrument, only the GE-SS-SRV software/firmware is required to create another node. Contact us for more details of available upgrade paths for your instrument.

Specifications subject to change
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