

**MIRION**  
Connect **21**  
Annual Users' Conference







# Environmental Monitoring Solutions

**Josh Handley, Steve Laskos**

Mirion Connect | Annual Users' Conference 2021  
Aurora, Colorado

# Monitoring Applications



On-site fixed monitoring in key areas (around perimeter, tanks, casks, buildings)



Off-site fixed monitoring by state agencies near nuclear sites



Portable, deployable & mobile systems for tracking radiological events



D&D activities – monitoring areas around construction

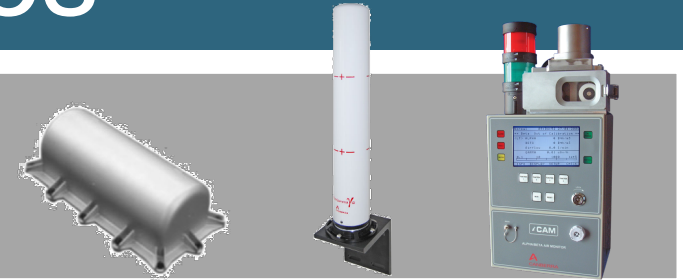


Robotic payloads to assess radiological events or automated survey of areas

# Monitoring Choices

## Instruments

- Gamma Area
- Alpha / Beta Air
- Spectroscopic



## Deployment

- Fixed Systems (indoor / outdoor)
- Portable / Deployable
- Mobile Systems
- Robotic Payloads

## Communications

- Mesh & WRM
- WiFi
- Cellular
- Satellite

## Software

- Supervisory Systems
- RadResponder



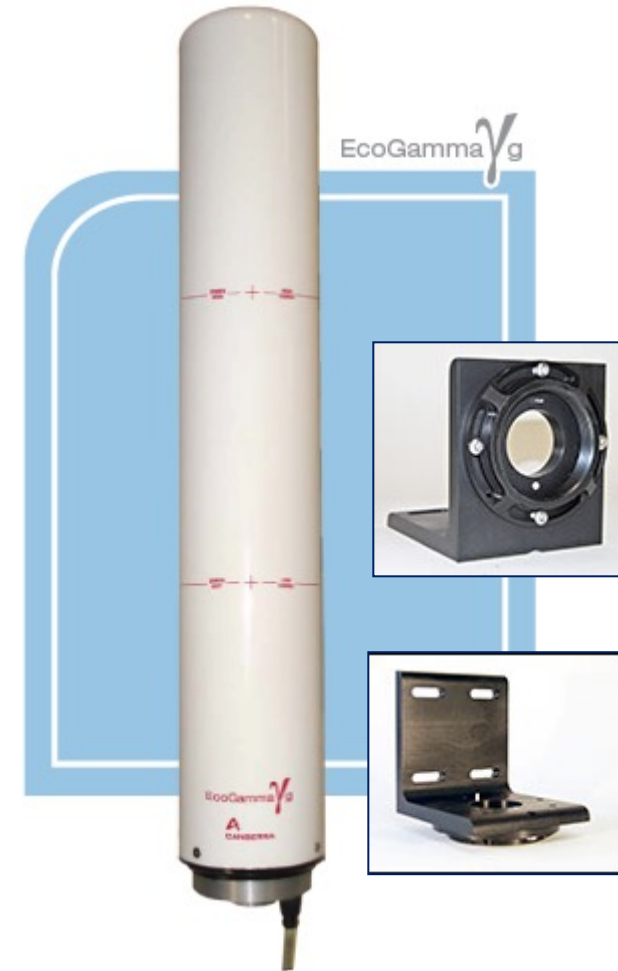
# Fixed Gamma Monitoring - EcoGamma

- Advanced, dual GM detector, environmental gamma radiation monitor
- Designed to operate in the most extreme conditions with unsurpassed accuracy, range and stability.
  - Temperature Range: -40°C to +60°C (-40°F to +140°F)
  - Enclosure is IP67 rated aluminum enclosure with threaded base, submersible up to one meter!
- Operating range
  - 10 nSv/hr (1.0 µR/hr) to 10 Sv/hr (1000 R/hr)
  - Linearity  $\pm 10\%$  referenced to Cesium-137 (H\*10 equivalent dose)
  - 30 keV to 5.0 MeV
- Power over Ethernet (POE) or USB



# EcoGamma Key Features

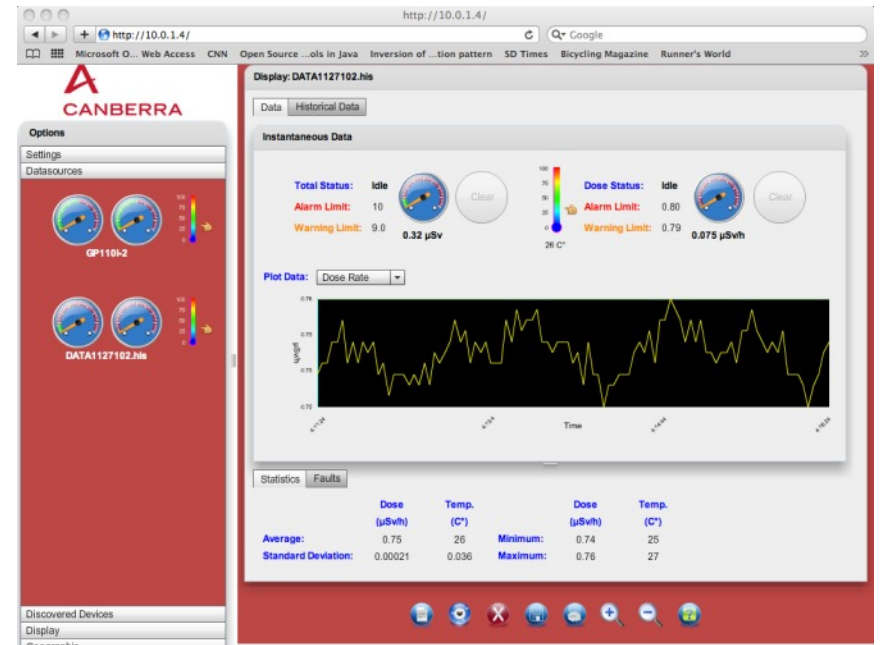
- Time To Count functionality
  - Extends operating range and life of detectors
  - Makes dead time a non-issue
- Large internal historical database
  - Holds about 180 days
  - Protecting loss of data in the event of a communications failure
- Diagnostics and Preventive Maintenance Data
  - Temperature
  - TID information
- Built-in calibration and linearity check functions
  - With test points and ranges scalable to local regulatory requirements





# EcoGamma Built-In Software

- Direct Access to Instrument with Browser
  - Live Dose Readings
  - Setup and Configuration
  - Updates
- Remote Communication
  - It can push information and files to external system
  - External systems can poll instrument via WebSockets interface
  - Enables easy integration into Supervisory systems



01

---

# EcoGamma Portable

Rapidly deployable “drop case” for collecting dose rate measurements in the field



# EcoGamma Portable



- Fully waterproof design within a Pelican case
  - Cellular modem for direct uploading of data to RadResponder
    - ▶ (Optional) Integrated Iridium satellite modem
  - ~4 days of runtime on battery
    - ▶ Runtime can be extended by connecting an external battery pack within a similarly-sized Pelican case
- *Just turn the keyswitch and drop it. It will automatically begin collecting and uploading data.*



# EcoGamma Portable

- Manages all acquisitions and communications for uploading data to RadResponder and other services
  - *Simple to add support for new services with custom formats*
- Automatic network failover, supporting multiple communication paths:
  - Ethernet/WiFi
  - Cellular
  - Satellite
  - ... Other communication paths (e.g. mesh network) or just writing data to disk for later extraction
- Continuously monitors all hardware and performs diagnostics to verify system health
  - External multi-colored (RGB) status indicators display system status
- Quick and easy functions via use of USB drive
  - Uses specially-crafted, encrypted files to provide commands to the system at any time
  - Rapidly provision systems or update configuration parameters (e.g. acquisition or upload rates)
  - Collect stored acquisition data off of the system
  - Perform software updates in seconds



# EcoGamma Portable

- EcoGamma
- FirstNet-certified cellular modem
- (Optional) Iridium Edge satellite uplink
- Embedded processing computer
- Charge controller
- LiFePO<sub>4</sub> battery
- External keyswitch & indicators



See it in  
the demo  
room!

02

---

## EcoGamma Mobile

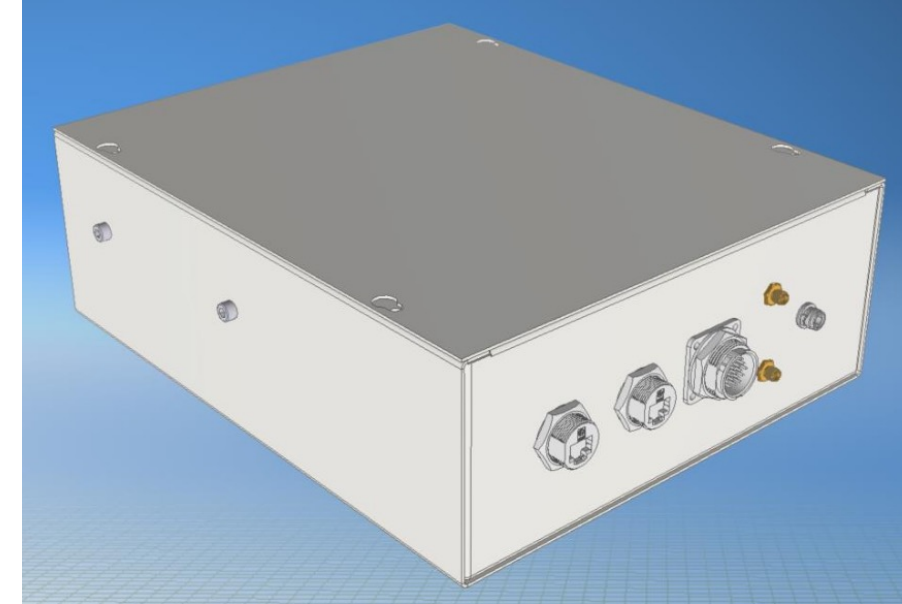
Vehicle-mountable system for real-time positional tracking and dose rate measurements



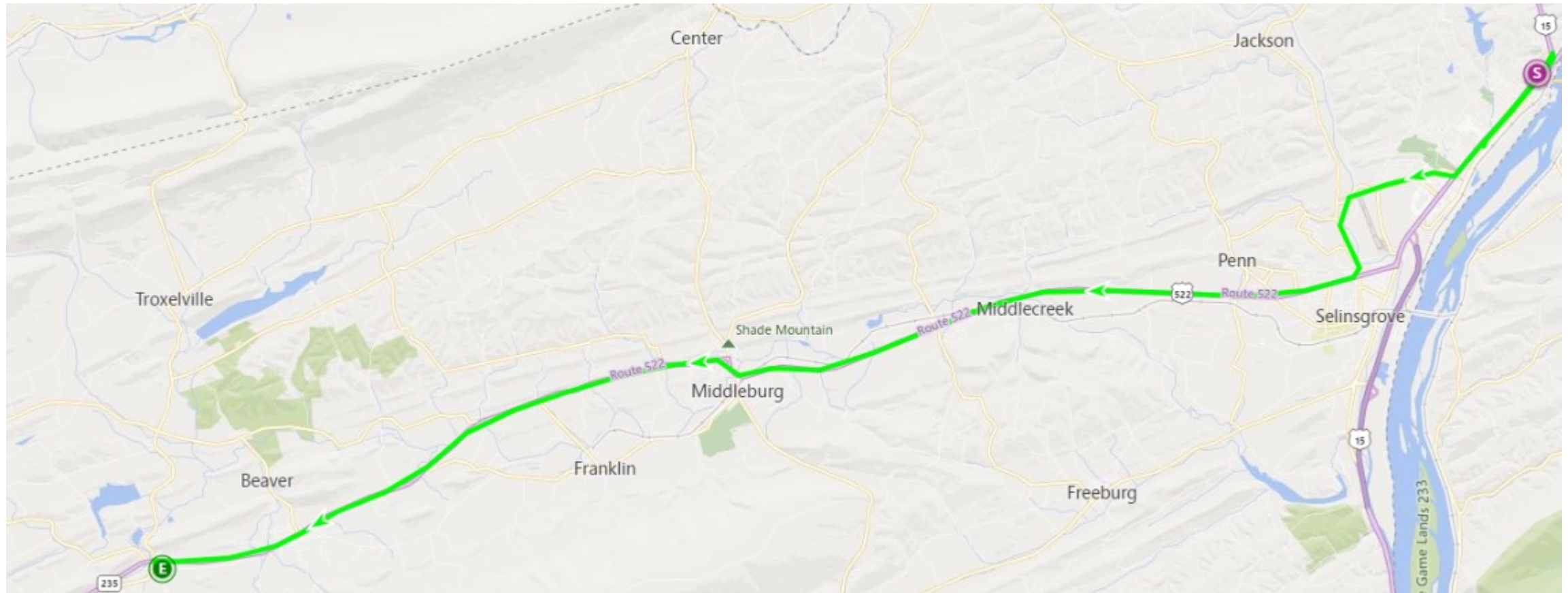
# EcoGamma Mobile



- Designed to be placed in vehicle or trailer
  - ▶ Wired to vehicle's 12V system
  - ▶ Uses ignition sense to control power of system
- External connections:
  - ▶ EcoGamma
  - ▶ Cellular & GPS antennas
  - ▶ (Optional) Satellite uplink
  - ▶ Power input
  - ▶ Has additional Ethernet connector for connection to a tablet/laptop to view EcoGamma data with a standard web browser in the vehicle for real-time feedback, while also uploading to RadResponder



# EcoGamma Mobile



03

---

## EcoGamma Fixed

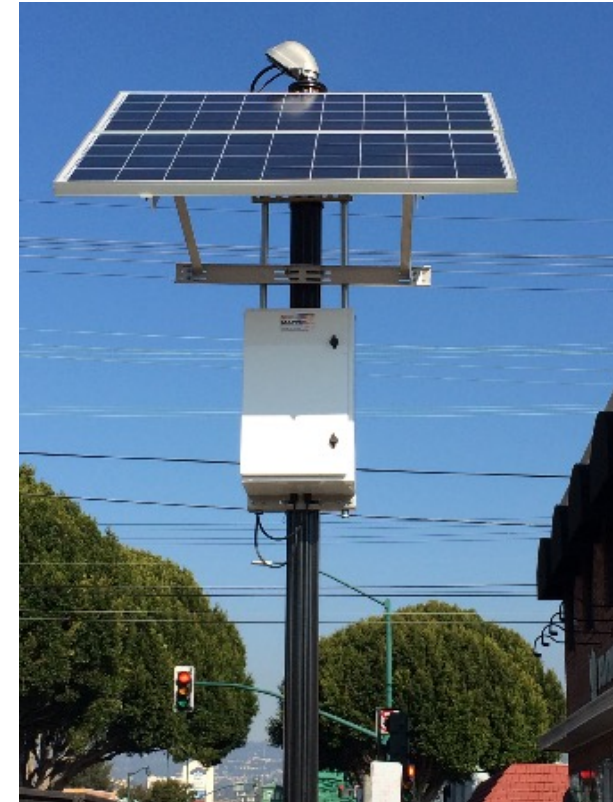
Waterproof, pole/wall-mountable cabinet for area monitoring  
with solar option



# EcoGamma Fixed



- The EcoGamma Fixed system adds reachback communications and multiple power options to allow for the placement of the EcoGamma-g monitor outdoors for site/statewide monitoring.
- Provides continuous, real-time measurements from the field.
- Each location has its own communications hardware (with optional redundancies) and solar power or battery-backup options.
- Well suited for harsh weather conditions and isolated locations.



04

---

## EcoGamma Kiosk

Waterproof, pole/wall-mountable cabinet for area monitoring  
with local indicators and display  
with solar option

# EcoGamma Kiosk

- Fully waterproof design
- Rated for operating temperatures of -30°C to +60°C
  - ▶ Uniquely designed for cold-temperatures without need for heaters
- Integrated light tower + adjustable horn
- 7" Touchscreen (sunlight readable, able to be used with gloves)
- 4-20 mA output of dose rate signal
- Dry-contact relay for alarm signal
- 1hr battery backup

See it in  
the demo  
room!



✓ *Just plug-in any EcoGamma and power up. All settings pulled from EcoGamma.*

# EcoGamma Kiosk





# EcoGamma Kiosk



Close-up of touchscreen display

05

---

## RadResponder Relay

Compact device for collecting data from CANBERRA/Mirion instruments and uploading the data to RadResponder

# RadResponder Relay

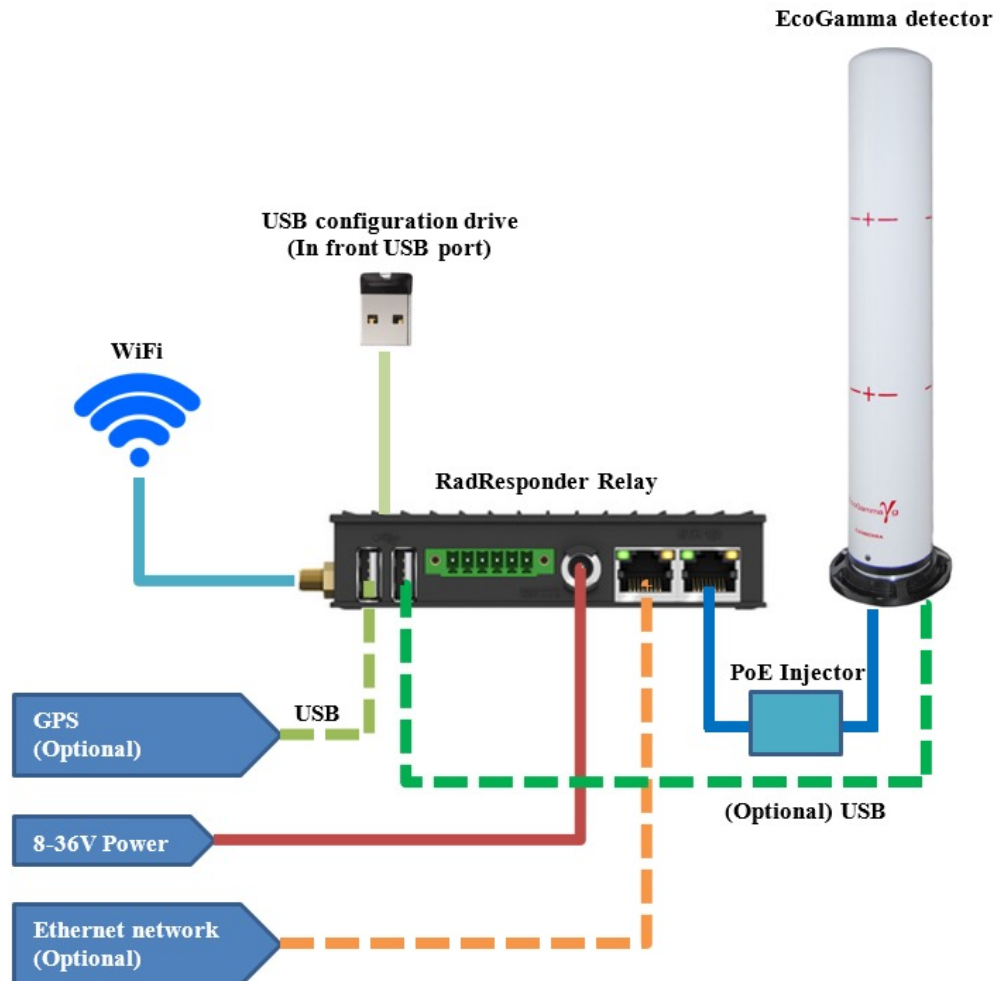
Designed for use with the



- Quad-core ARM Cortex-A53 (1.8 GHz)
  - (2) Ethernet ports, (3) USB ports, RS-232, & RS-485 ports (e.g. for iCAM communications)
    - ▶ Initial support for EcoGamma, iCAM, GPS, cellular, and satellite communications
  - WiFi 802.11ax
  - Fanless design with all-aluminum housing
  - Certified industrial temperature range (-40° to 80° C)
  - Power input: 8-36V, 2-7W
- *For unique installs or existing systems utilizing Mirion/CANBERRA instruments requiring their data to be uploaded to RadResponder.*
- *Just make the hardware connections and turn it on. It will automatically begin collecting and uploading data to RadResponder and manage data queues and communication failover.*



# RadResponder Relay Connections



- A highly configurable and flexible system
  - The RadResponder Relay unit handles all communications/protocols and uploading of the collected data to RadResponder
- **Current instrument support:**
  - EcoGamma
  - iCAM
  - GPS
  - WiFi
  - Cellular modem
  - Satellite modem
  - External indicators
- **Upcoming instrument support:**
  - Data Analyst



06

---

## Quadruped Unmanned Ground Vehicles (Q-UGVs)

Boston Dynamics' Spot, integrated with Mirion instruments for hazardous and routine measurements

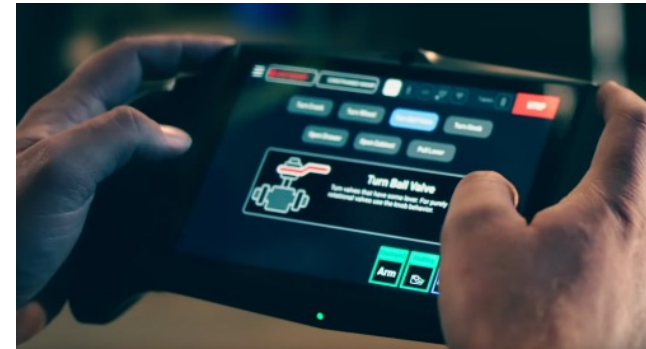
# Spot

See it in  
the demo  
room!

- The world's leading quadruped robotics company, Boston Dynamics, developed "Spot" – the most advanced Q-UGV on the market.
  - Extremely easy to operate without the safety and training issues of drones/UAVs
  - Fully autonomous operation, with automatic routine routes and charging options
- Current payload utilizes a SPIR-Explorer sensor with  $\text{LaBr}_3$ , providing dosimetry and spectroscopic measurements
  - Most any of Mirion's other detectors can also be integrated, with swappable payload support, as well as other non-rad sensors (e.g. chemical, IR, or LIDAR)
    - MicroGe and GR-1 CZT detector can be used for directed measurements
- Can automatically traverse stairs
- With optional arm, can even automatically operate doors and manipulate valves



# Spot



07

---

## iCAM Environmental Monitor

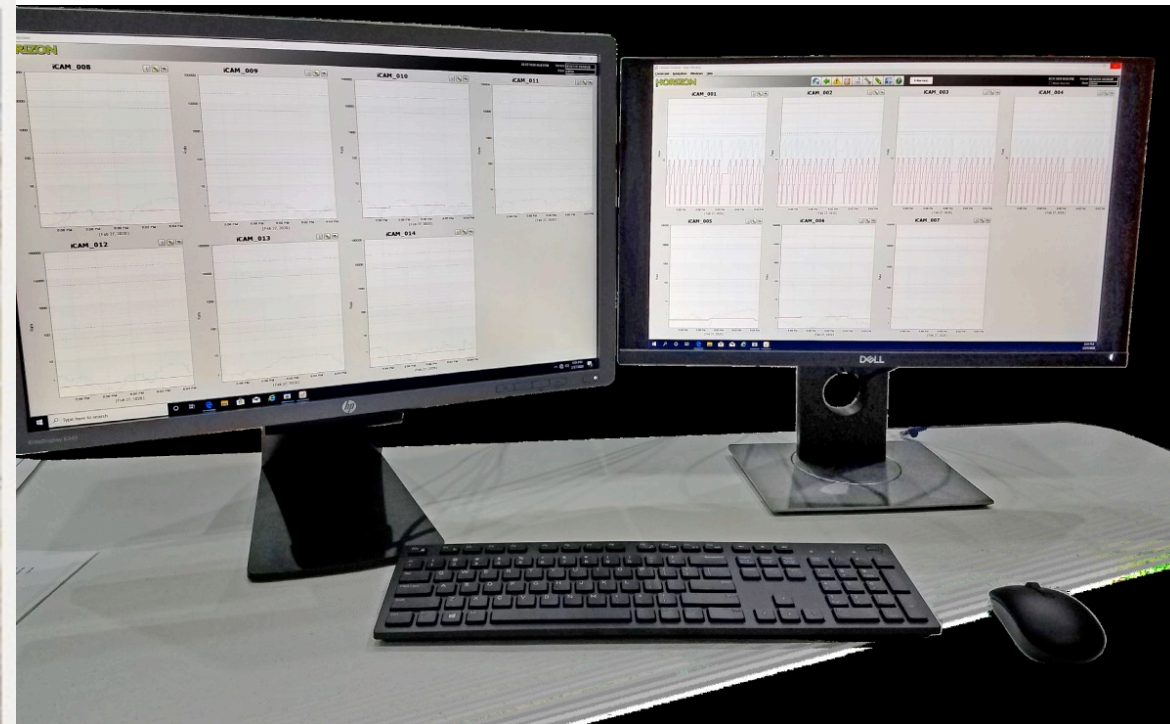
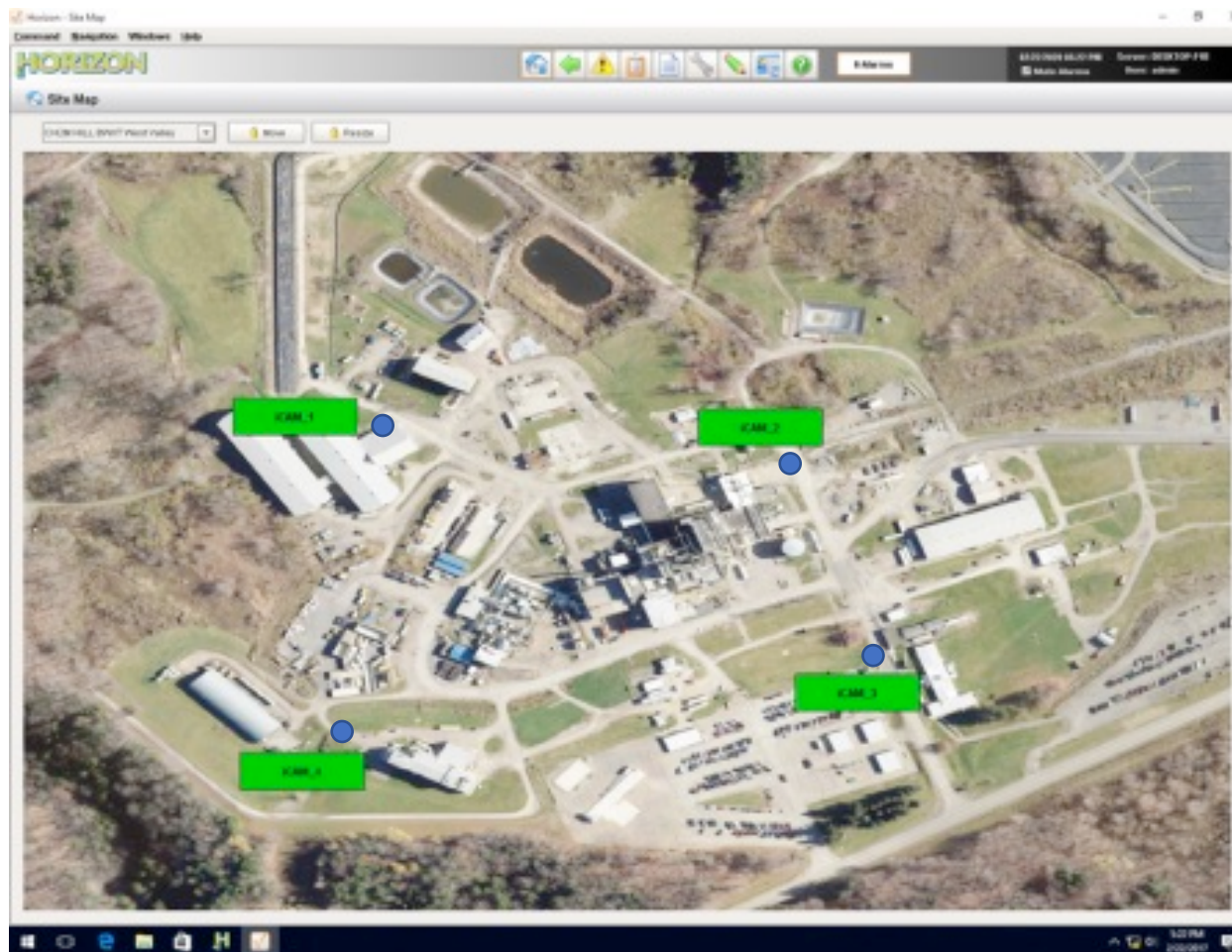
Alpha/Beta Continuous Air Monitor in environmental cabinet for D&D activities



# iCAM Alpha/Beta Air Monitoring

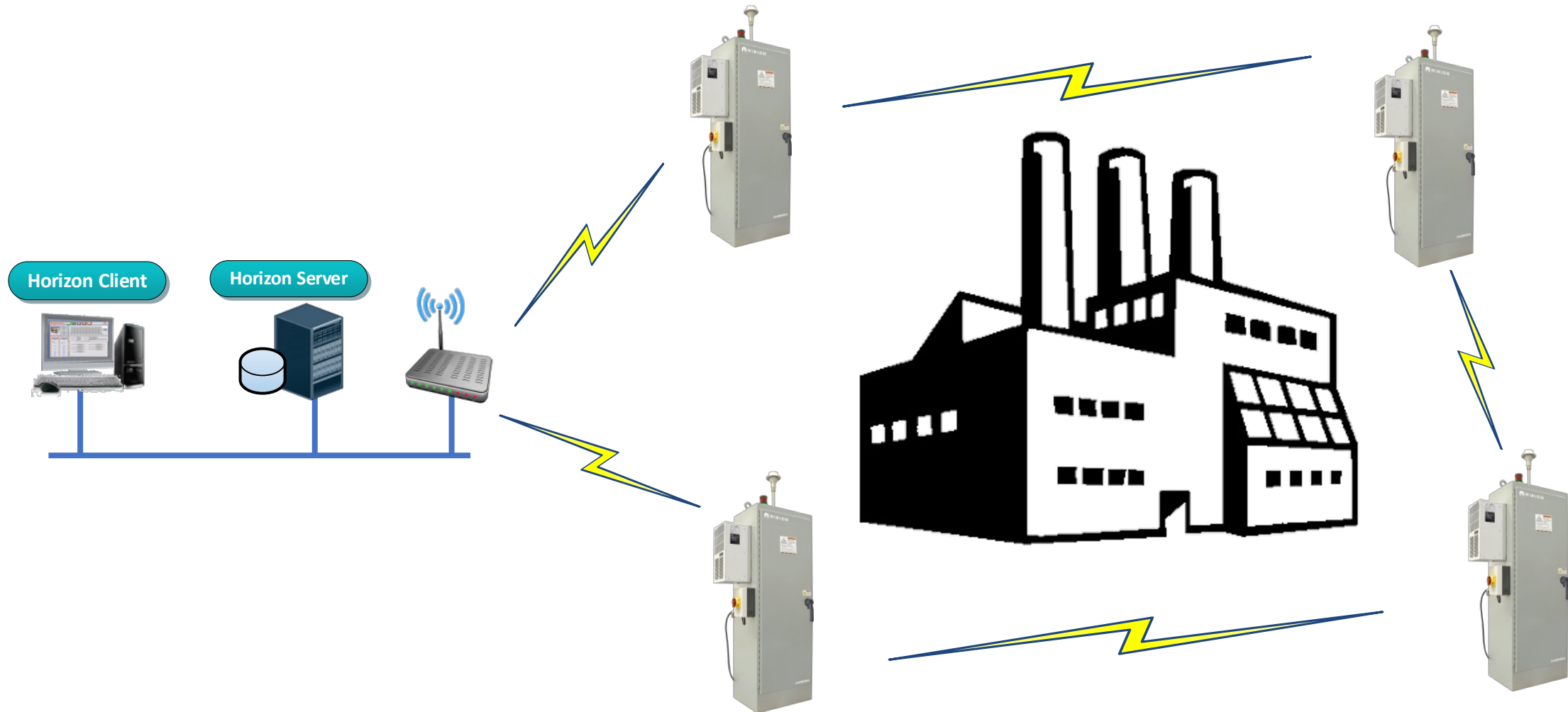


# D&D Solution with Mesh





# D&D Solution with Mesh



08

---

# Supervisory Systems



# Supervisory Solutions



They help manage large numbers of instruments

Record data in historical database

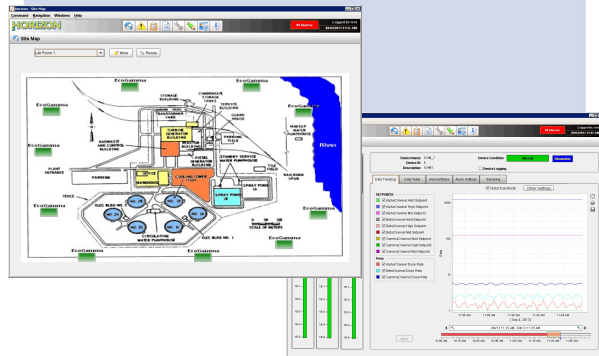
Visualization of live or historical data

Reporting & data export tools

# Supervisory Solutions

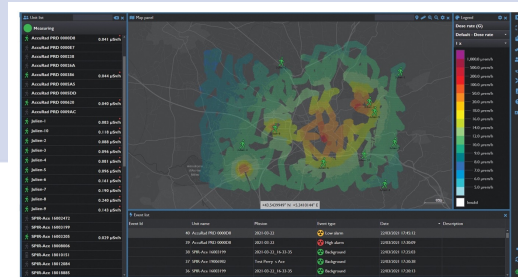
## Horizon

- Best for in-plant and on-site fixed instruments
- Gamma area, CAMs and continuous spectroscopy instruments



## SpirVIEW Mobile

- Suited to missions & public events where overlay on a map & playback is important
- Portable & mobile instruments with GPS tracking on maps



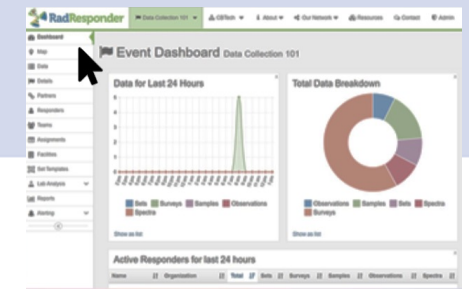
## Teleview 3000

- Best for plant telemetry of worker dosimetry & area/perimeter monitoring
- Dosimetry, gamma area monitoring, CAMs



## RadResponder

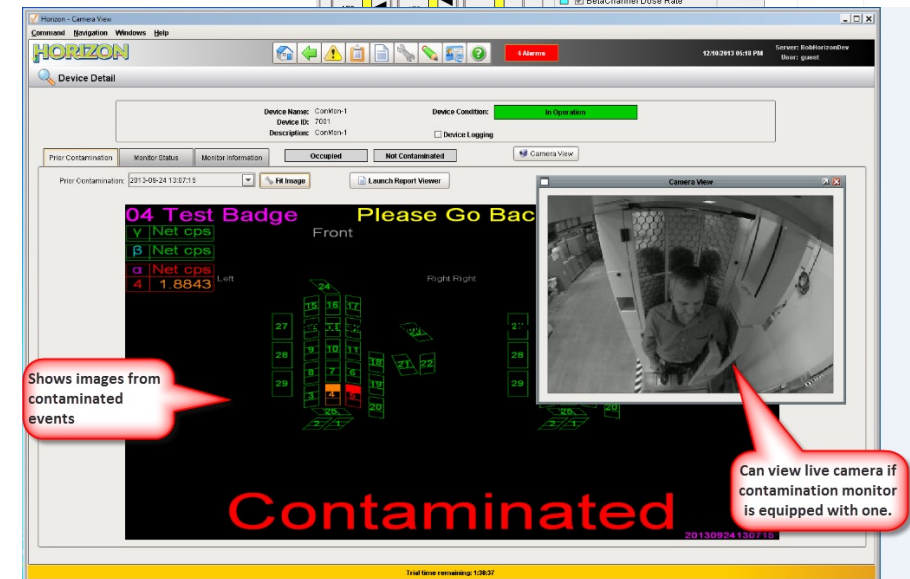
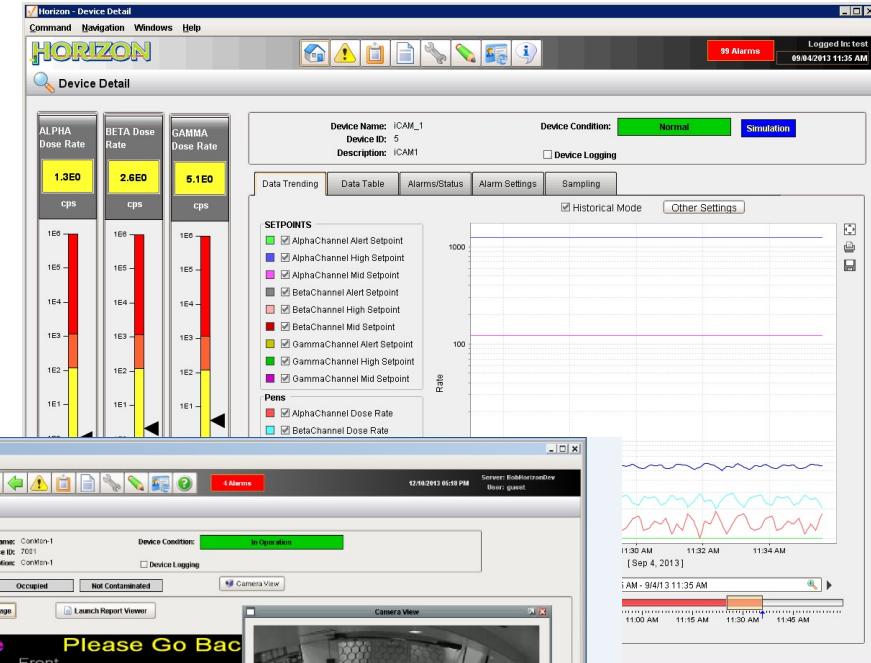
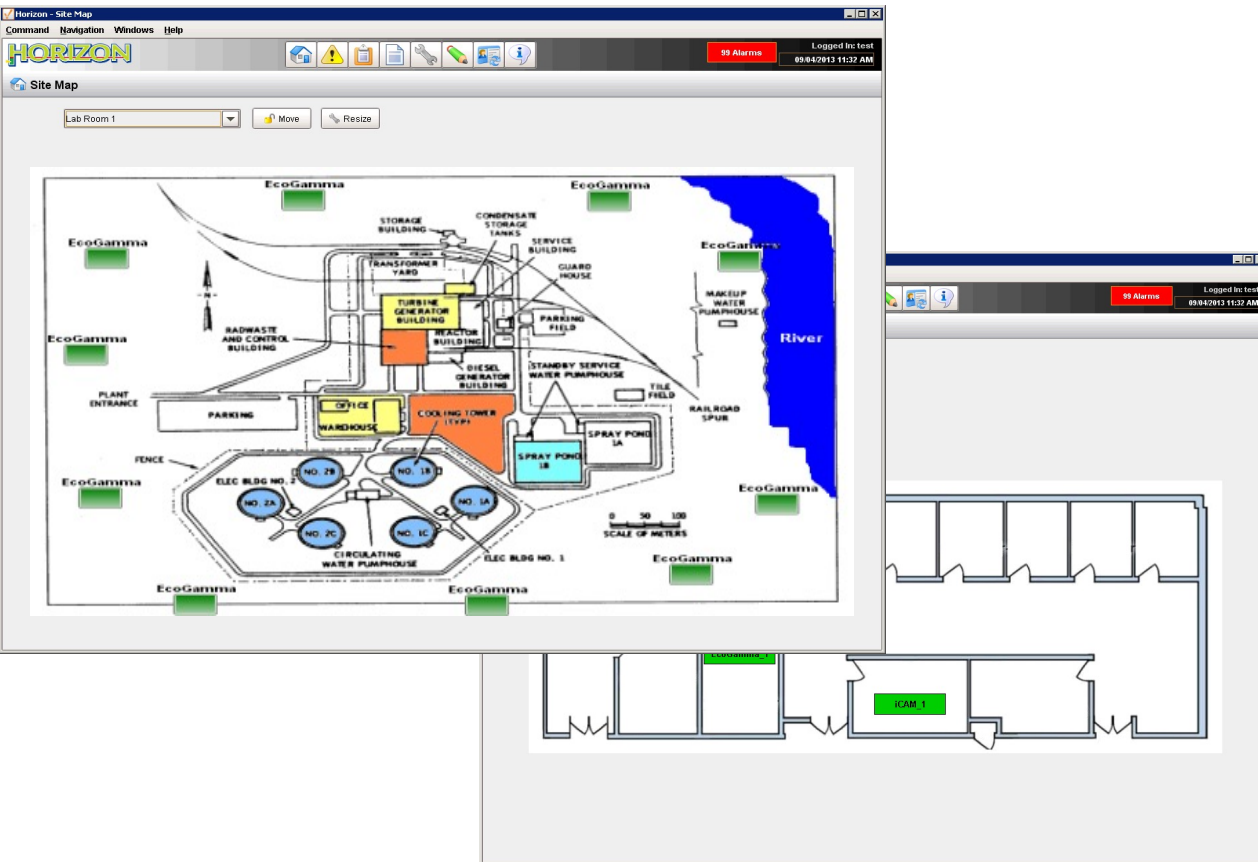
- Centralized radiological database for federal, state, and local response organizations



# Horizon

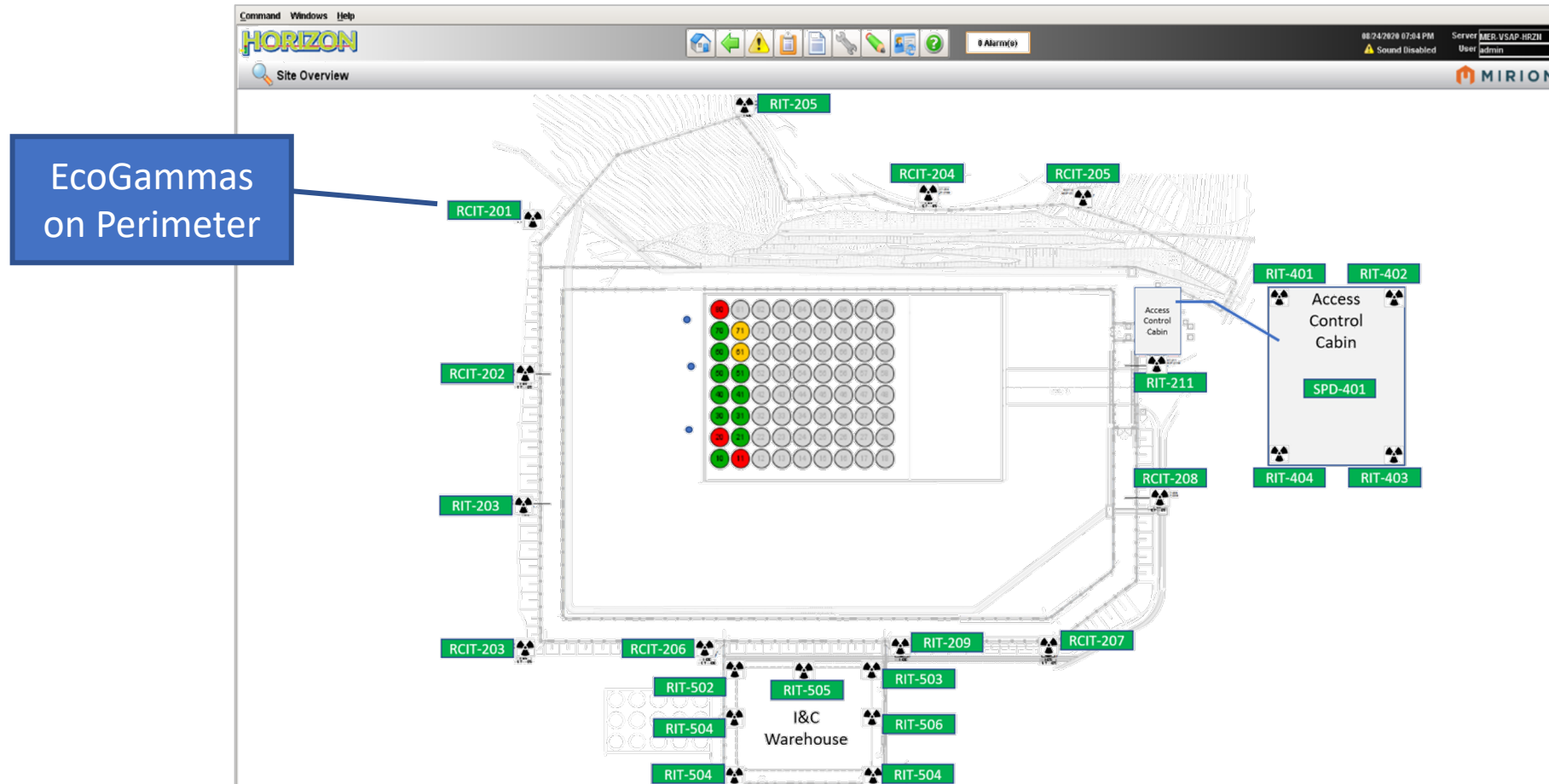
## Site Overview Screens

## Device Detail Screens

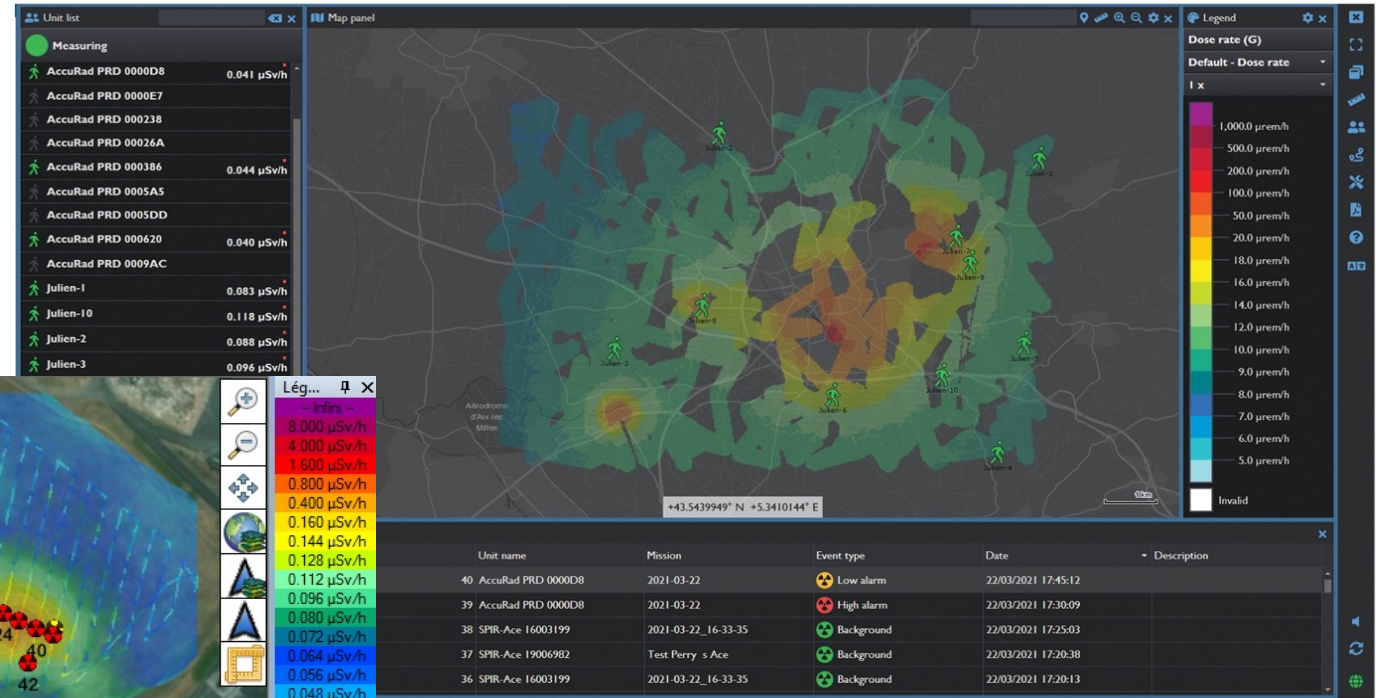




# Horizon Cask Monitoring Example



# SpirVIEW Mobile



*SPIR-Ident*

*SPIR-Ace*



*SPIR-Explorer*



*SPIR-Pack*



*SpirVIEW Mobile*

*AccuRad*





# RadResponder

- Jointly developed by several agencies: FEMA, DOE, NNSA, EPA, DTRA
- Provides true real time situational awareness during a radiological or nuclear emergency
- Aggregates data from all participating agencies

The screenshot displays the RadResponder web application interface. The top navigation bar includes the RadResponder logo, a dropdown menu for 'Development Testing 2', a user profile for 'Mirion (CANBERRA)', and links for 'About', 'Our Network', 'Resources', and 'Contact'. The left sidebar contains a menu with options: Dashboard, Map, Record Data, Data (expanded), Data Collection Sets, Surveys, Samples, Field Screenings, Analytical Results, Radiological Spectra, Observations, Dosimetry (highlighted), Responder Tracking, Mobile Surveys, Attachments, and Associations.

The main content area is divided into two sections. The top section, titled 'Dosimetry', features a search bar with 'Quick Search' and buttons for 'Partial' and 'Exact' search. Below the search bar is a table with columns: ID, Latest Reading, Personnel, Type, Severity, Accumulated Dose, and Unit. A single entry is shown for ID 856, dated 12/01/2020 17:32, by Spruytte, Julien, with a Gamma type and Low severity. The bottom section, titled 'Surveys', also has a search bar and a table with columns: ID, Collected Date/Time, Type, Severity Level, Value (Raw), Units (Raw), and Location. Three entries are shown, all with a Gamma type and Low severity, collected on 12/13/2019.

ID	Latest Reading	Personnel	Type	Severity	Accumulated Dose	Unit
856	12/01/2020 17:32	Spruytte, Julien	Gamma	Low	0.004168	Rem

ID	Collected Date/Time	Type	Severity Level	Value (Raw)	Units (Raw)	Location
118281901	12/13/2019 10:22	Gamma	Low	129.0	uRem/hr	43.69974, 5.089399
118282001	12/13/2019 10:21	Gamma	Low	176.0	uRem/hr	43.69974, 5.089399
118282101	12/13/2019 10:21	Gamma	Low	78.8	uRem/hr	43.69974, 5.089399

# Integrate Raw Data

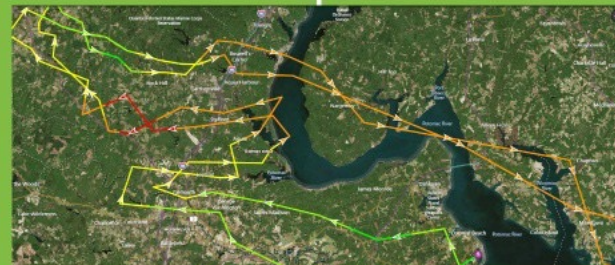
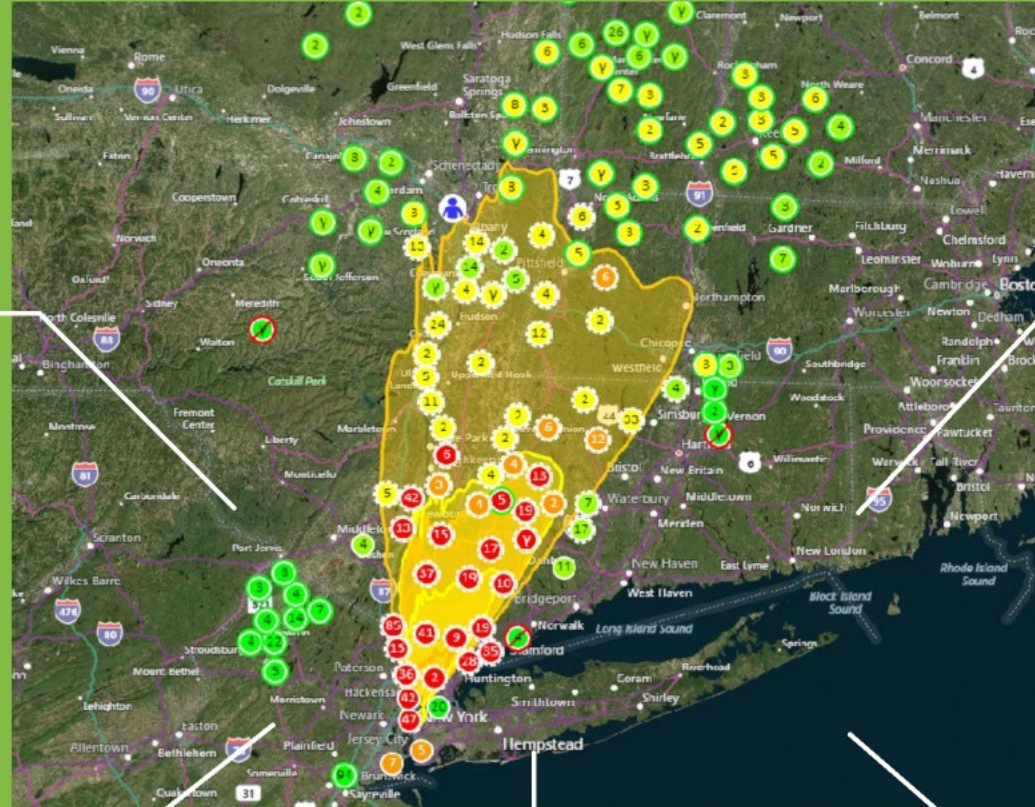


- Field Surveys
- Field Samples
- Observations
- Spectra
- Dose Readings
- Data Sets

Mobile application uploads data in real-time, saves data locally when no connection is detected

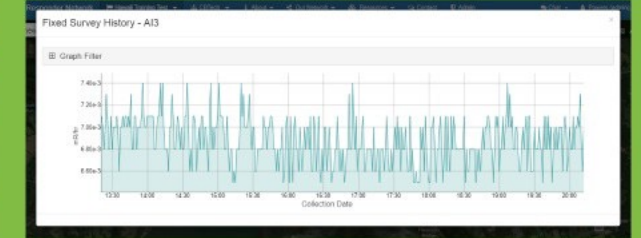
Collected	Type	Severity Level	Value (Raw)	Units (Raw)	Team	Collected By	Comment	Location
9/25/2018 16:43	Gamma	Background	2.74000	uR/hr	--	Altkon, Christine	--	38.9152 -77.2301
9/10/2018 14:30	Gamma	Background	3.00000	uR/hr	Strike Team 1	Taylor, Josh	--	38.9555 -82.7591

Enter individual records or bulk upload data via the **website**



## Mobile Surveys:

Track paths from vehicles, flights, & backpacks



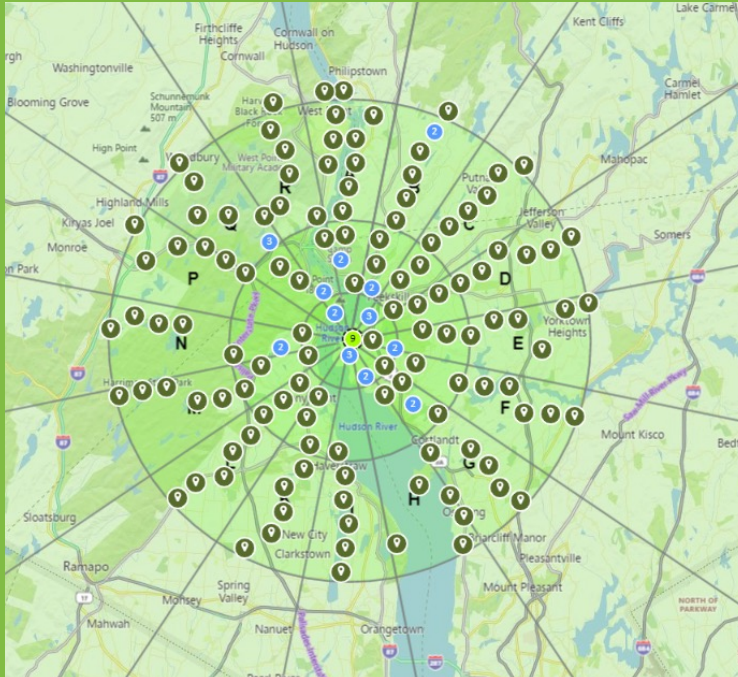
Integrate **fixed monitoring sensors** to stream minute-by-minute data



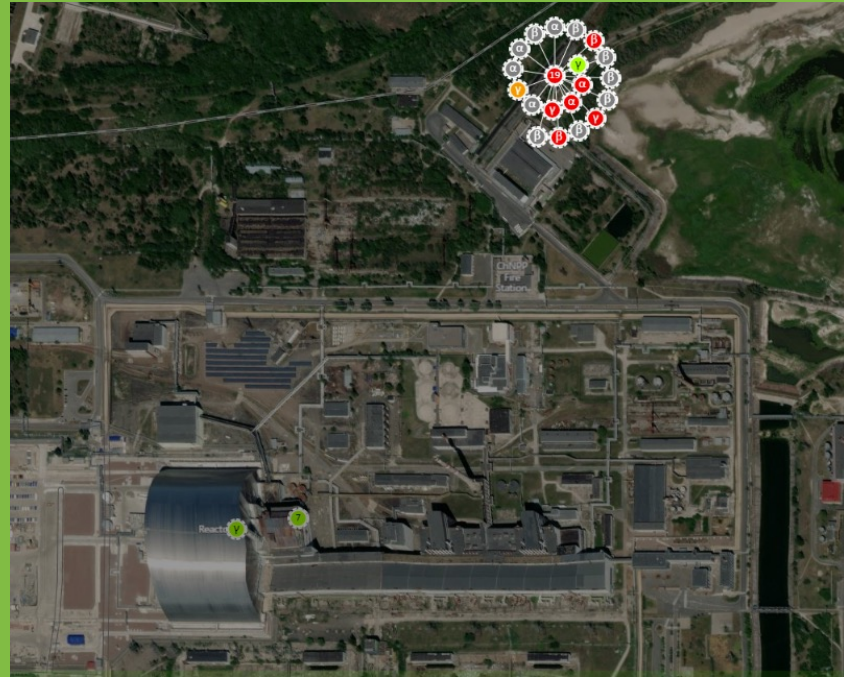
Integrated **API equipment** can telemeter data directly to RadResponder



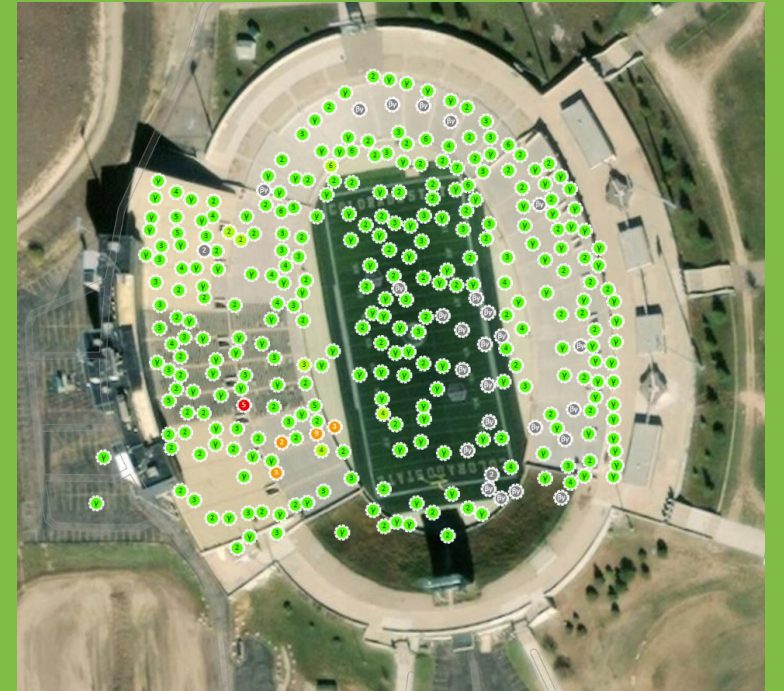
# Recent Use Cases



**Nuclear Power  
Plant Release**



**Routine Monitoring/  
Background Mapping**



**PRND/Special  
Event Monitoring**



# Thank You

