Region 3 RAP
Aerial Monitoring System (AMS)

Ron Smith and Amber Dailey

Savannah River Site

April 16th 2010

730-4B

Aerial Monitoring Systems

- Nellis Air force Base RSL west- Las Vegas Nevada
- Andrews Air force Base RSL east-Washington DC
- Savannah River Site Region 3 RAP- Aiken South Carolina
- Others
  - EPA, NOAA, Los Angeles Sheriff Department, and Chicago Public Safety

Why Aerial Monitoring – Historic Event

Operation Morning Light – 1978

Russian Nuclear Powered Satellite crashes into Canada.

Canada requested United States to assist with locating radioactive debris along the 20 mile wide 400 mile long crash corridor.

US teams performed aerial surveys locating discrete pieces of radioactive debris from the reactor on board Comos954.

Why Aerial Monitoring – Now and Future

- Terrorism
  - Improvised nuclear device
  - Radiological dispersal device
  - Lost or stolen sources/radioactive material
- Nuclear power facility accident
  - Chernobyl
  - Three mile island
- Nuclear Proliferation, Military
- Geophysical, snow pack,

Region 3 AMS Gamma Detection System

- Manufactured by Radiation Solutions Inc
  - RS-701 data acquisition console
  - RSX series gamma detectors
    - 4"x4"x16" NaI
    - 2"x4"x16" NaI
    - 3"x3" NaI
  - Trimble GPS (integrated)
  - Computer XFR D630
  - RadAssist acquisition software
    - GIS software integrated for real-time mapping of radiation data
- Iridium satellite modem
- Dual element AeroAntenna (GPS and Iridium)

Region 3 AMS Gamma Detection System

Region 3 Aerial Platform

- Currently both fixed wing and helicopter are available
  - Customs Border Patrol (CBP) out of Jacksonville Florida and Corpus Christi Texas, utilize the P3 Orion a four engine turbo prop aircraft supporting a crew of 18. The P3 provides 12 hours of air time between fueling. Each P3 had a Dual element antenna installed for operation of the AMS GPS and iridium.
  - Wackenhut Security Inc (WSI) out of the Savannah River Site utilizes the BK-117 helicopter. WSI provides aerial support for the southeast US.

CBP P3 Orion

P3 Orion AMS Work Area

P3 Aerial Detection System Configuration

WSI BK-117

BK-117 AMS Work Area

BK-117 Aerial Detection System Configuration

Flight Patterns For Search Operations

- Lost/Stolen Source
  - Parallel lines to locate source.
- Deposition Mapping
  - Serpentine pattern for boundary determination.
- Plume Track
  - Flight is adjacent to plume. Distance from plume is set by gamma count rate. Location and down wind distance determined.

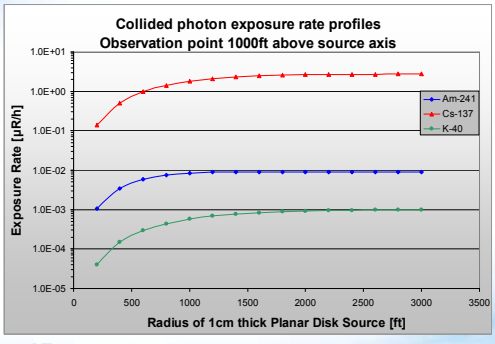
Gamma Detection Sensitivity

- Factors Affecting Gamma Detection
  - Geometry
    - Distance from radioactive material
    - Attenuating media between detector and radioactive material
    - Detector
    - Source geometry
  - Aircraft
    - Velocity
    - Altitude
  - Operational
    - Search pattern – parallel line offset distance
    - Communications with pilots

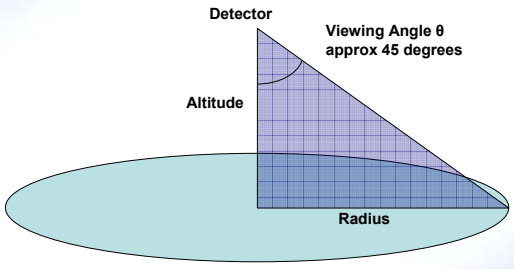
Flight Operations - Communication

Communcations with the flight crew for altitude, heading, and ground speed is important.

Gamma Detection-Spatial Contribution

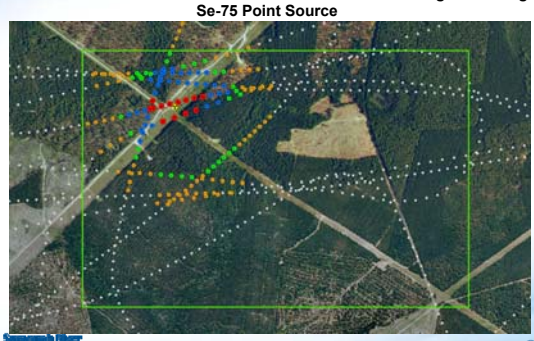


Gamma Detection – Gamma Contribution



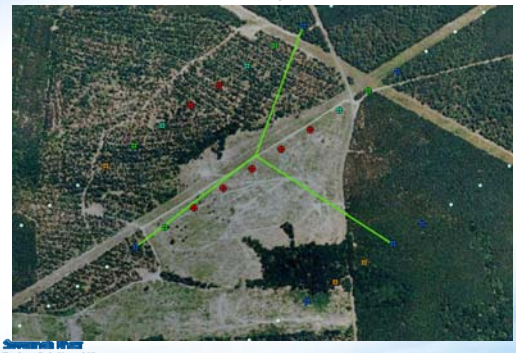
Bk-117 1000 Feet AGL 100mph Ground Speed

Source to detector distance 1800 feet – Gamma counts 7sig above Bkg
Se-75 Point Source

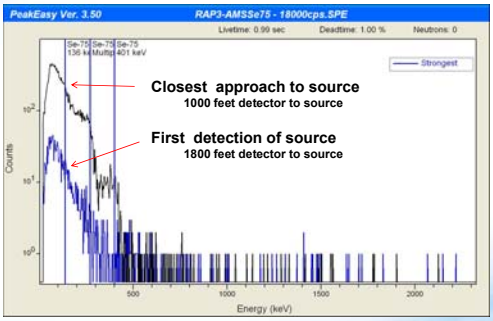


P-3 Orion 1000 Feet AGL 200mph Ground Speed

Source Position – Graphic Determination

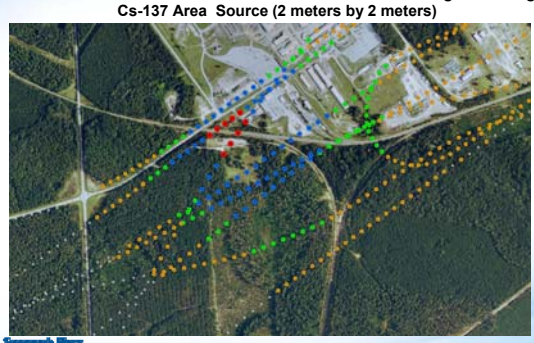


Se-75 Spectra – One Second Acquisition



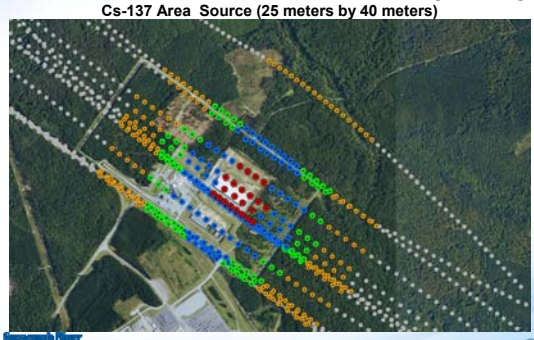
Bk-117 1000 Feet AGL 100mph Ground Speed

Source to detector distance 1800 feet – Gamma counts 7sig above Bkg
Cs-137 Area Source (2 meters by 2 meters)

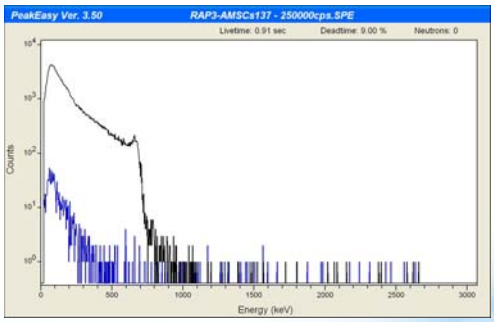


Bk-117 1000 Feet AGL 100mph Ground Speed

Source to detector distance 2100 feet – Gamma counts 7sig above Bkg
Cs-137 Area Source (25 meters by 40 meters)



Cs-137 Spectra – One Second Acquisition

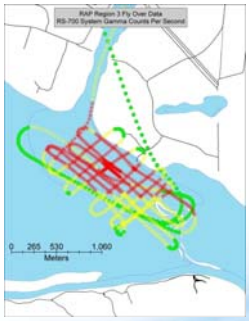


BK-117 100 Feet AGL 40mph Ground Speed

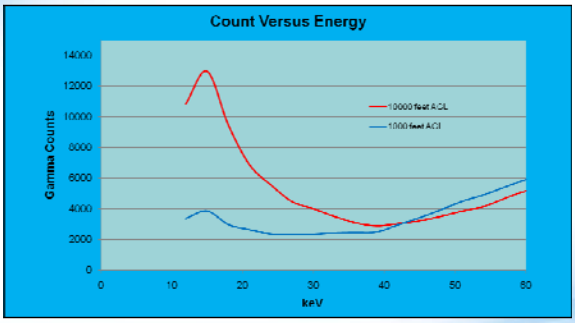
BK-117 Helicopter 100 feet above the ground, 40 mph ground speed.

Large Area Source.

RS-701 configured with single 4"x4"x16" Nal detector.



Spectral Shape With Altitude Change - 12 keV to 40 keV



Spectral Shape With Altitude Change - 450 keV to 700 keV