

Mapping (Nuclear) Radiation from Aerial Platforms in 3D

A.k.a. Making Nuclear Radiation Visible in 3-D (in "color" & real-time)

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Mapping from Aerial Platforms "Gamma-Ray Eyes in the Sky"







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Detection and mapping of radiological materials from small unmanned aerial systems (UAS) or drones – Enormous advances in autonomous systems provide unparalleled capabilities for in-accessible or hazardous areas





Berkeley Applied Nuclear Physics Program

Mapping from Aerial Platforms "Gamma-Ray Eyes in the Sky"





 Here, w/ 2x2 array of Csl detectors Detection and mapping of radiological materials from small unmanned aerial systems (UAS) or drones – Enormous advances in autonomous systems provide unparalleled capabilities for in-accessible or hazardous areas



 Processing and display in near-real time!
Data reconstruction done on the platform, only data products are transferred.





Mapping from Aerial Platforms "Gamma-Ray Eyes in the Sky"





- 3-D LiDAR models of neighboring buildings

0.5 mCi Cobalt-60

→ 13min UAS flight measurement
→ 3 story building made of thick concrete
→ Hidden source in 3rd floor corner room



Mapping of Distributed (Two) Sources @ INL



> Two blast locations with 0.7 Ci and 0.3 Ci Br-82 ($T_{1/2}$ ~ 3 hrs)





Real-time and on-board, 3D scene mapping and data fusion!

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Location: Idaho National Lab Measurement area: ~10,000 m² Measurement time: < 10 minutes



3D Volumetric Reconstruction (SDF)



Significantly enhanced speed and accuracy in detecting and reconstructing both distributions (in 3D)!

Radiological Contamination Mapping in Fukushima Scene-Data Fusion: "Seeing Gamma Radiation in 3-D"





Radiation Mapping at Chornobyl The "Claw"





Summary

- Enormous advances in sensing, data processing, computer vision, and autonomous systems provide unprecedented capabilities in detecting and mapping radiological and nuclear materials in 3D from aerial platforms;
- At the core of our research is the fusion and reconstruction of scene & contextual data with radiological detection and imaging data providing the ability to visualize radiation in 3-D and in real time.
- These data processing and 3-D data fusion concepts could be applied to other quantities and signatures, such as hyperspectral (e.g. vis and IR), radar, etc.



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