Introduction

This project aims to develop a gamma-ray spectrometry system with an unmanned aircraft system (UAS). This system fills a gap between portable measurement systems and full-sized airborne systems, and complements the car-borne measurement systems. Sources can be approached closely, providing good sensitivity with a relatively small instrument. The operating range allows for measurements to cover a large area in less time than e.g. portable systems. Urban environments are applicable. A test flight with the microdrone MD4-1000 [1] was performed in 2011 [2]. UAS of this size can carry a payload mass of about 1 kg, which limits the choice of detectors. The evaluation of a candidate detector is presented here.

Applications

- Survey NPPs
- Search for orphan sources
- Secure public areas
- Identify sources with high dose rate
- Survey accident sites
- Survey container sites
- Geophysical surveys

The UAS also provides footage of the source and site.

Detector evaluation

The IGEM Spectroscopy System [3] was considered a suitable detector given the low weight (288 g) and the turnkey configuration. The system uses a CdZnTe detector. The evaluation approach was to calculate the MDA for a given speed and altitude for the system. Count rate efficiencies were measured with two sources (\(^{137}\text{Cs}\) and \(^{131}\text{I}\)) to cover a wider energy range. The count rates at specific positions passing a point source were calculated by distance and air attenuation. A scenario was setup to give an idea of the detection limit for the system. The detector was compared with a handheld RIID, the GR-135 [4], with a 4 cu. in. NaI detector.

Detector evaluation results

|                      | IGEM               | MDA (\(^{137}\text{Cs}\)) | 38 MBq
|----------------------|--------------------|---------------------------|--------
| Line spacing         | 0.25 km\(^2\)      | MDA (\(^{131}\text{I}\)) | 19 MBq  
| Speed                | 10 m               | GR-135                    | 8 MBq  
| Altitude             | 5 m                | MDA (\(^{137}\text{Cs}\)) | 8 MBq  
| Total distance       | 25500 m            | MDA (\(^{131}\text{I}\)) | 4 MBq  
| Total time           | 85 min             |                           |        |

References

[5] Nuclear Data Center, Korea Atomic Energy Research Institute, atom.kaeri.re.kr

Future Work

- Aircraft vehicle evaluation
- Scandicraft [6]
- Detector evaluations
- Multidetector system
- \(\beta/n\) detection
- Air sampling
- Search strategies
- Validation
  - Exercises
  - Calibrations
- Data management and presentation
  - Deviation display [7]
  - Presentation in Google Maps/Earth
  - Info sharing
- Monte Carlo simulation of the system

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