EGU22-11835
https://doi.org/10.5194/egusphere-egu22-11835
EGU General Assembly 2022

RadHawk: a smart UAV for hunting radioactivity

Matteo Albéri[1,2], Daniele Cabras[3], Enrico Chiarelli[1,2], Luca Cicala[4], Tommaso Colonna[5], Matteo Corbo[6], Mario De Cesare[4,7,8], Antonio Ferraro[3], Jacopo Givoletti[6], Enrico Guastaldi[5], **Andrea Maino**[1,2], Fabio Mantovani[1,2], Massimo Morichi[6], Michele Montuschi[1,2], Kassandra Giulia Cristina Raptis[1,2], Filippo Semenza[1,2], Virginia Strati[1,2], and Franco Vivaldi[6]

[1]Department of Physics and Earth Sciences, University of Ferrara, Ferrara, Italy
[2]INFN, Ferrara Section, Ferrara, Italy
[3]DroneLAB Aviation, Nuoro, Italy
[4]CIRA, Italian Aerospace Research Centre, Capua, Italy
[5]GeoExplorer Impresa Sociale S.r.l., Arezzo, Italy
[6]CAEN S.p.A.,Viareggio, Italy.
[7]Department of Mathematics and Physics, University of Campania "Luigi Vanvitelli", Caserta, Italy
[8]INFN, Napoli Section, Complesso Universitario di Monte S. Angelo, Napoli, Italy

Vertical take-off and landing Unmanned Aerial Vehicles (UAVs) for Gamma-Ray Surveys (GRS) provide a cost-effective and timely approach tool for environmental radioactivity mapping. The UAV technique combines the advantages of ground and airborne measurements: there is no need for an airport for take-off and landing, and high spatial resolution surveys can also be performed in dangerous areas without endangering the operators.

The main limitation of existing UAVs for GRS is the lack of software and hardware integration between avionics systems and radiation detectors. RadHawk fills this gap with an advanced mechanical, electronic, and software connection between a specifically developed quadcopter and a digital Multi-Channel Analyzer GammaStream (GS). The GS is coupled with a 2" $CeBr_3$ scintillator having spectral energy resolution ~60% better than that of a NaI for ^{137}C detection. Communication between the GS onboard microcomputer and the drone's autopilot Pixhawk is achieved through a custom protocol which allows sharing telemetry updates and executing commands.

The best spatial resolution of radiometric data is achieved through a list mode real-time processing that generates, with optimized acquisition time, energy calibrated georeferenced gamma spectra. A radio frequency transceiver module sends data to a control station, where the user can easily control the flight path and check the artificial radionuclides warning for real-time identifying of hotspots.

A post-processing algorithm based on a Full Spectrum Analysis – Maximum Likelihood Estimation was developed to enhance the identification capability of anthropogenic radionuclides and to produce maps of the K, Th and U abundances of the investigated areas.