UAV prototype for terrain dose-rate mapping

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Origins of the project

- ✓ AGE CNEA-CAE requires a surface dose rate map
- ✓ Large measuring area (8km^2), requires automated process
- ✓ Requires periodic measurements
- ✓ Due to possible high dose levels prefer to reduce the exposure of people
- ✓ GIAR works on a project for multipurpose flying vector

Particular conditions

- ✓ Rough terrain
- ✓ Inaccessible areas and obstacles (perimeter fencings)
- ✓ Requires static measurements (depends on detector volume vs exposition time)

Objectives of the project

➢ Mechanicals

- ✓ Light
- ✓ Robust

➢ Measurement

- ✓ Count measurement with geospatial reference
- ✓ Detection efficiency
- ✓ Telemetry

Requirements of project

➢ Navigation

- ✓ Autonomy
- ✓ Controllability (altitude, full featured AP, secure mode, inertial NAV)
- ✓ Telecommand (power off of not used modules)

➢ Auxiliar systems

- ✓ Real time Video Link

Our proposal

- ✓ We requires a flying vehicle (UAV). But what kind?

Feature	Plane	Helicopter	Drone	Balloon
Weather sensitivity	Medium	Medium	Medium	**High**
Autonomy	Medium	Low	Low	High
Sturdiness	Medium	Low	Medium	High
Maneuverability	Medium	High	High	Med-High
Speed	Med-High	Low	Med	Low-static
Landing requirements	Medium	Low	Low	Low
Design complexity	Medium	High	Medium	Low

Main Features

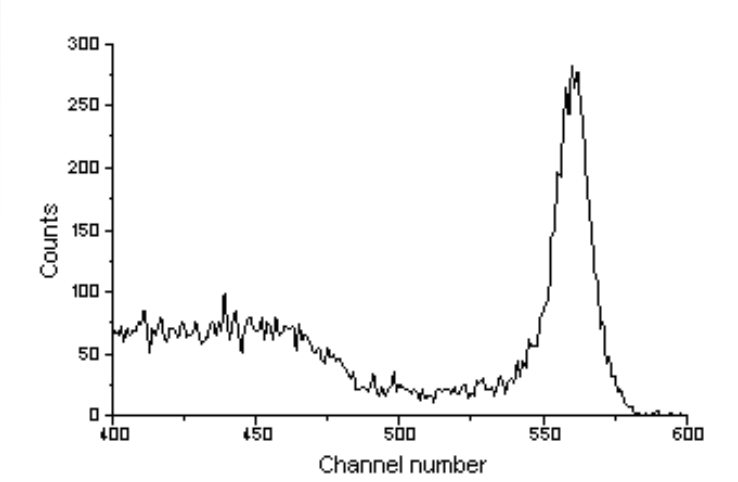
- ✓ Sonar obstacle avoidance system
- ✓ Sonar altimeter
- ✓ AHRS system (IMU)
- ✓ Video link
- ✓ Autopilot
- ✓ Real time telemetry and telecommand
- ✓ Entirely designed and build by us. All materials available off-the-shelf
- ✓ **Up to 6 hours autonomy**
- ✓ **Easy scalability (more Helium, more payload)**
- ✓ **Very low cost (USD 600), without detector**

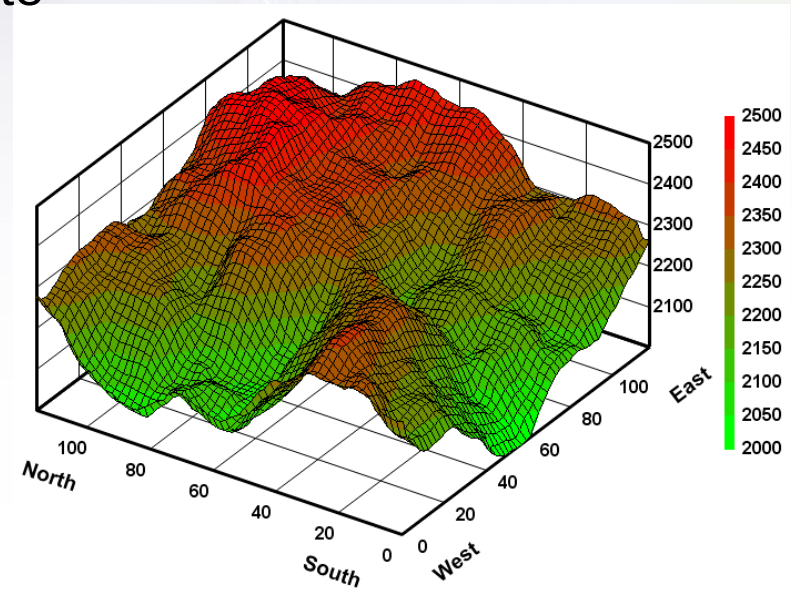
Legal, regulatory and safety

- ✓ ANAC (National Civil Aviation Association) (UAV, Res. Nº527/2015)
- ✓ Helium (instead of heated air or Hidrogen)
- ✓ Negative floatability
- ✓ Secure mode Auto Pilot (3 modes)
  - ✓ Shut-off
  - ✓ Return to base
  - ✓ Secure landing

Other features

- ✓ 3D surface map
- ✓ Gamma Ray Spectrometry
- ✓ Microcontroller based for low count rate
- ✓ FPGA based for high count rates





Future Works

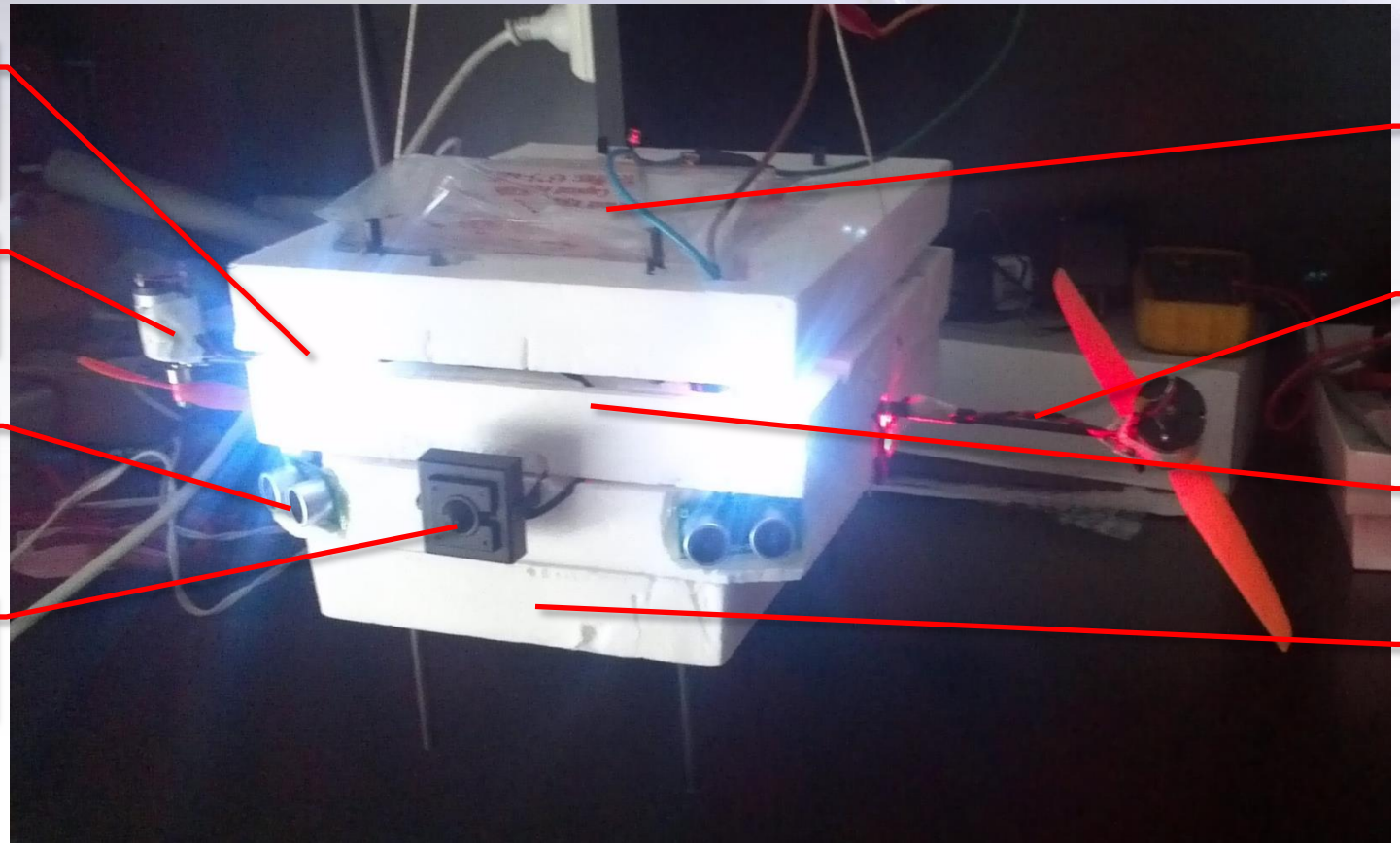
- ✓ Plastic detectors
- ✓ Silicon PMT
- ✓ High precision GNSS (Global Navigation Satellite System)
- ✓ Relation between measure time and weight of scintillator material and volume
- ✓ Background characterization

Calibration

- ✓ Measure counts by a Scintillator (NaI(Tl))
  - ➢ need to convert to dose rate

Interface Prototype

Vehicle Prototype



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