INTEGRATED SYSTEMS

MagNIMBUS

Airborne magnetometer system powered by QuSpin Gen-2 sensors

Integrated.ugcs.com

MagNIMBUS

Ultra-sensitive airborne integrated magnetometer system powered by QuSpin Gen-2 atomic total-field magnetometer sensors

Typical applications are:

- Searching for UXO (unexploded ordnance) and landmines in metallic casings
- Tramp metals and lost GET (ground engagement tools) detection
- Locating buried infrastructure (metal pipes and shielded cables)
- Archaeology
- Surveying for any metal objects weighing a hundred grams or heavier lying underground

Image: MagNIMBUS in vertical gradiometer configuration in flight over UXO-contaminated area.

Unique system design allows to fly with extremely low surface-to-sensor clearance starting from just couple of dozens of centimeters. If the sensor will touch the ground or obstacle/vegetation that will not lead to the drone crash. That capability is extremely important for searching for small UXO items over the fields with vegetation.

Self-foldable sensor mount allows easy take-off and landing without excess requirements for drone operator qualification as it is for magnetic sensors on suspension cords.

https://integrated.ugcs.com/
Phone: +371 25453422 (EET/GMT+2)
Sales: ugcs@ugcs.com Support: support@ugcs.com

Main components of the system:

- Recommended drone: DJI m300 RTK. Standard kit comes with all mountings/cables for this drone, sets for other types of drones, including Pixhawk-based, are available by request.
- Foldable mount with build-in QuSpin Gen-2 magnetic field sensor.
- Mast with QuSpin Gen-2 sensor for vertical gradiometer configuration. SkyHub onboard computer – acts as datalogger for magnetic field sensors and implements terrain following mode for DJI drones.
- Altimeter (laser or radar).
- UgCS Expert flight planning/management software.

Recommended software for data processing: Geosoft Oasis montaj.

System variants

MagNIMBUS comes in two possible configurations:

- Vertical gradiometer. This configuration greatly simplifies data processing and makes magnetic base station not necessary.
- Configuration with single sensor with foldable mount. Detection capabilities are the same as for gradiometer setup, but requires experienced specialists for data processing, magnetic base station is recommended in case of surveys in proximity of sources of magnetic fields.

UXO/landmines detection note

The system is capable to detect a range of items ranging from hand grenades (estimated sensor-target distance for robust detection for target like F1 fragmentation hand grenade is 1.0m) till big ERW (explosive remnants of war) like aerial bombs at the distance of few meters.

While the system is capable to detect some types of landmines (TM-62M, OZM-72 and similar types with considerable amount of ferrous metal), landmines search is not a direct application of the system as it can't detect most of types of landmines. That means that the system never should be used to confirm absence of landmines in certain area but it can be used on non-technical survey stage of clearance process to find signs of presence of UXO/landmines with considerable amount of ferrous metals.

https://integrated.ugcs.com/
Phone: +371 25453422 (EET/GMT+2)
Sales: ugcs@ugcs.com Support: support@ugcs.com

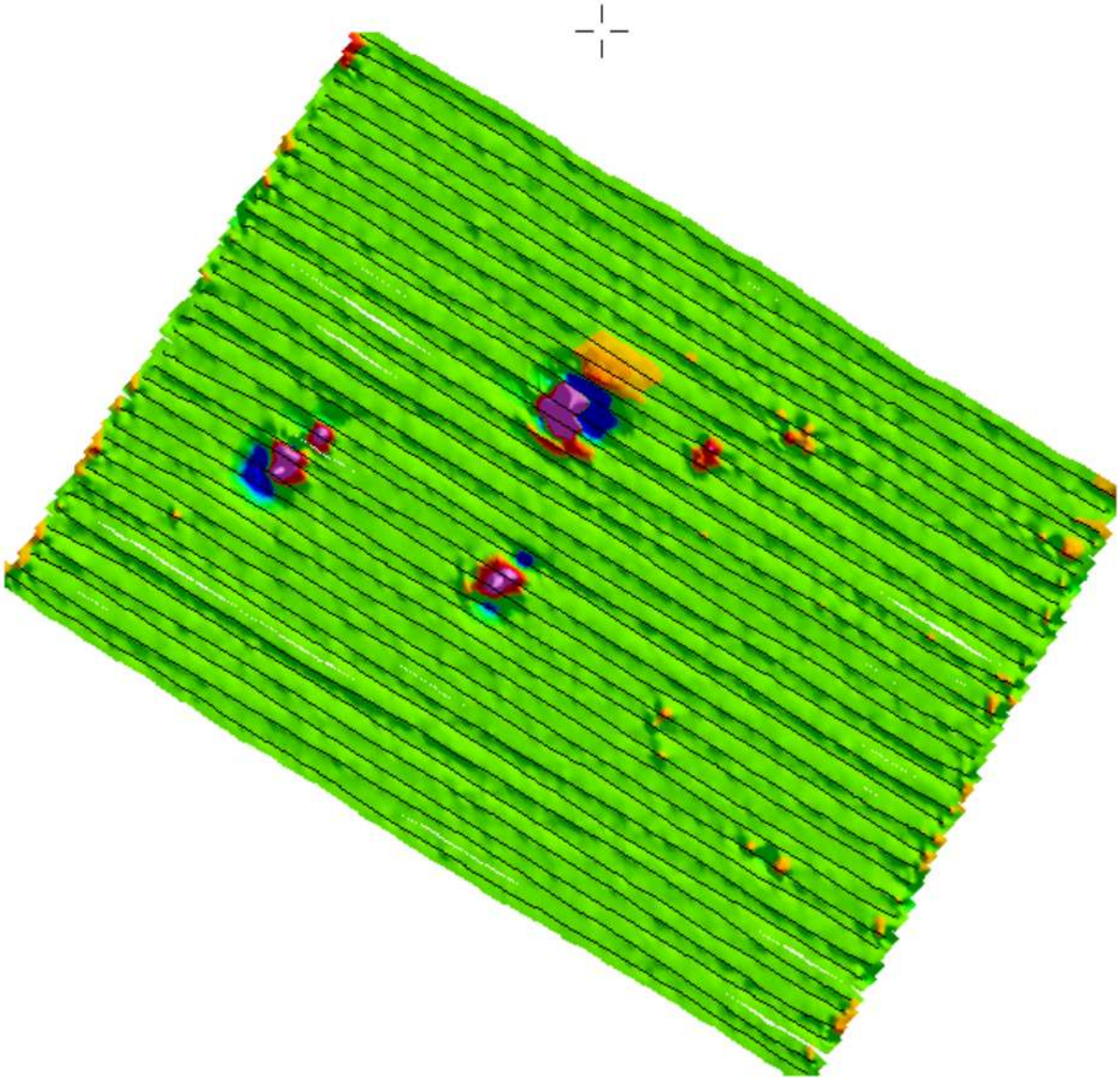

Image: Processed data for survey of former shooting range. Big anomalies are 72mm and 150mm artillery shells as well as short piece of metallic pipe. Small anomalies are metallic scrap (pieces of artillery shells etc.). Vertical gradiometer data was processed in Geosoft Oasis montaj.

Utilities detection

The system is effective to search metallic pipes and powered electric underground cables.

https://integrated.ugcs.com/
Phone: +371 25453422 (EET/GMT+2)
Sales: ugcs@ugcs.com Support: support@ugcs.com

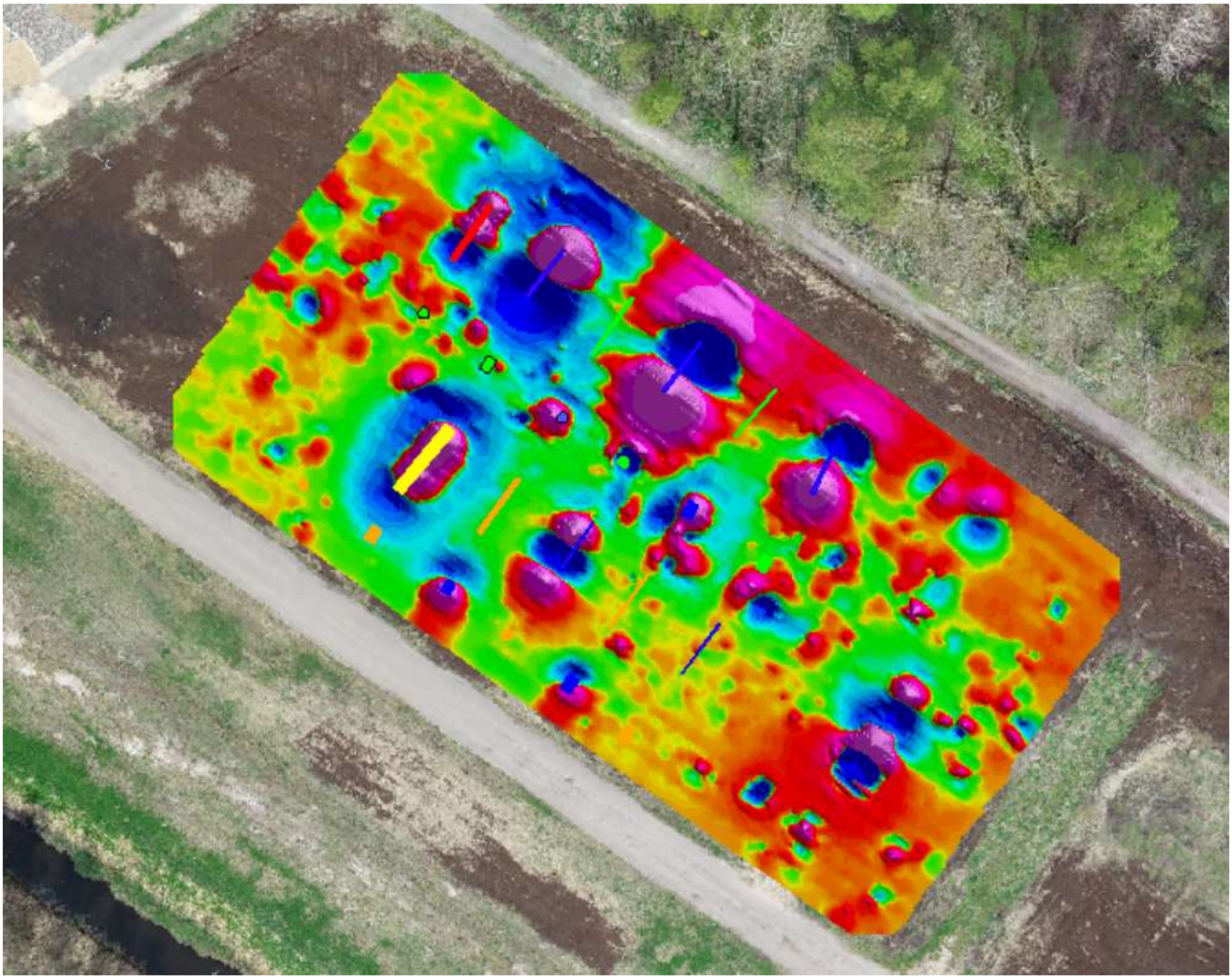

Image: processed data for survey over SPH Engineering's own test range. Detected targets are reinforced concrete and metallic pipes as well as metallic barrels. Small anomalies are metallic scrap. More information about test range and targets: https://integrated.ugcs.com/sph-engineering-test-range-for-drones-with-geophysical-sensors

Productivity of data acquisition process

Time required to survey certain area depends on 2 main factors:

- Distance between survey lines
- Flight speed

For UXO search distance between survey lines depends on types of expected items. For robust detection (from 2x parallel survey lines) of small items like hand grenades or submunitions it is recommended to have distance between lines as small as 0.5m.

For bigger items as artillery/mortar shells optimal distance between lines is 1m.

Flight speed should be defined by flight safety considerations and type of terrain. In case of not rough but typical terrains scenarios like farm fields recommended flight speed is 2...4m/s.

So, for worst case scenario (0.5m separation between survey lines, 2m/s survey speed) time required to scan 1ha will be estimated as

Number of survey lines: 100/0.5 = 200 lines

Total length of survey lines: 200 * 100 = 20 000m

Additional length of perpendicular lines and fly-in/fly-out segments: 200m

Required flight time at 2m/s flight speed: 20200m / 2m/s = 10100s or 168 min.

For DJI m300 RTK drone flight time with magnetometer system will be 30 minutes. Having 15 minutes break between flights for batteries change etc. time required to survey 1ha with 0.5m between lines at 2m/s flight speed will be approx. 4.5 hours.

Using the same formulas, flight time required to scan 1ha with lines separation 1m at the speed 4m/s will be just 45 minutes and will require around 1 hour in total.

https://integrated.ugcs.com/
Phone: +371 25453422 (EET/GMT+2)
Sales: ugcs@ugcs.com Support: support@ugcs.com