British Columbia Technical Working Group on Indian Residential Schools (BC TWG IRS)

Ground-penetrating radar (GPR) is the most common geophysical search method for locating unmarked burials; it is the system with the longest history and strongest track record for this task. Until recently most GPR systems were single-channel arrays, but recently companies are marketing drone-based GPR systems for use in archaeology and in the location of unmarked burials.

What is UAV/Drone GPR?

GPR uses EM (electromagnetic) waves of different frequencies to detect subsurface patterns based on their influence on the reflection of EM waves. Most GPR systems use wheeled carts to carry the antennae, batteries, odometer, and computer control unit. Drone-based systems use a UAV/drone to fly the GPR antennae over the ground. Drone GPR has to fly close to the surface of the ground (about 1 m above), but is able to cover much more area than cart systems.

What Role Can Drone GPR Play in Identifying Missing Children?

GPR systems work by sending out EM (electromagnetic) waves which penetrate the ground. Patterns in the subsurface cause the waves to reflect back to the receiving antenna in ways that are influenced by the patterns below ground. To accurately assemble the reflected signal and to generate precise maps of the results, cart systems rely either on high precision GPS or on the discipline of laying out rectangular grids to guide the GPR collection lines. Drone GPR systems only use high precision GPS and are able to quickly cover large areas of interest and produce accurate maps of results.

What Are the Challenges of Drone GPR?

Drone GPR systems fly over the ground but need to have a clear space between the drone and the ground surface – so they are only useful when working in areas that have been cleared of vegetation or other surface obstructions.

Cart-based GPR systems rely on the close connection between the GPR antennae and the ground to ensure the maximum signal strength in the ground, which results in better signal depth and refection strength. Drone systems lose signal in the air space between the drone and the ground surface resulting in a weaker signal. This means that drone GPR results are less able to detect complex subsurface patterns or fainter reflected signals. Drone GPR results need amplification (gain) to boost the reflected signal to a form that is interpretable. As a result, drone GPR systems work best when the background geology is relatively homogenous and non-reflective and the patterns of interest are highly reflective, such as when mapping buried stone architecture in sand. Although it has not yet been tested, burials in cemeteries or similar contexts may be visible, at least to some degree, with drone GPR.