Wide-Area UAV Aeromagnetic Surveys to Detect Orphaned Oil and Gas Wells

Alex Nikulin[1], Timothy De Smet[1], Natalia Romanzo[1], Andrii Puliaiev[2]
[1]Binghamton University; [2]Ukranian Multirotor Technologies

Abstract

We present results of an extended field study focused on developing and field testing a UAV-based magnetometer system to autonomously detect and identify abandoned and unmarked oil and gas wells in an area of historical hydrocarbon exploration and development in New York State. These wells pose significant environmental and economic challenges in areas where hydrocarbon development took place, or where it may take place in the coming years. With recent estimates suggesting that there are over 320,000 orphaned wells just in the United States it is critical to consider low-cost wide-area survey methodologies to detect and identify orphaned wells for their subsequent remediation. Recent advances in autonomous unmanned aerial vehicle (UAV) technology, coupled with successful efforts to miniaturize total field magnetometers offer a unique opportunity to deploy UAV-mounted systems for wide-area high-resolution magnetic surveys. Our results indicate that magnetic anomalies associated with metal casing of vertical wells are pronounced considerably above background levels both at the surface and up to 50 m above-ground elevation. We determined that a detection altitude of 40 m is optimal in terms of avoiding any canopy interference, while recording magnetic data at highest signal-to-noise ratio. This methodology allows for rapid detection and identification of unmarked wells, in turn allowing for future sustainable development of these areas. We argue that UAV-based magnetometer surveys are a paradigm shift in near-surface geophysics, as they drastically reduce the time, labor, and cost associated with detecting orphaned oil and gas well, even in heavily forested areas.