

## **Integrating Aerial and Ground-based LiDAR in Appalachian Heritage Planning and Visualization**

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**Introduction:** The Natural Resource Analysis Center (NRAC) at West Virginia University is building a portfolio of integrated LiDAR (Light Detection And Ranging) projects in the areas of historic preservation, heritage planning, and visualization. Airborne, long-range, and close-range ground-based LiDAR technology is applied to the documentation of geographic areas and the construction of three-dimensional digital models at 'regional', 'site', and 'building/structure' scale. The models provide benefits to many disciplines, particularly resource management, historic preservation and landscape architecture creating enhanced opportunities for research. In accurately combining pointclouds, models provide for landscape documentation, analysis, planning and visualization.

**Methodology:** Data is collected using an airborne Optech ALTM 3100 and two ground-based scanners- a Riegl LPM i800-HA (800 meters range) and a Faro Photon 80 LS (77 meters range). Bringing together data from multiple instruments is a challenging operation that requires extensive investigation and trouble-shooting. The integration of various types of three-dimensional scanning data, specifically airborne and terrestrial, is only accomplished by utilizing differentially corrected GPS data, accurate interpolation and/or geo-rectification of distinguishable landscape features. Combining these technologies allows researchers to accurately map large scale terrain features with airborne data while being able to visualize, model, and analyze critical smaller features via static terrestrial LiDAR within one working project file.

**Application- Henderson Hall Historic District Planning at Multiple Scales:** The narrative of the Henderson Hall Plantation (WV) is connected to the Aaron Burr conspiracy as his plans for creating an independent nation germinated at Blennerhassett Island, ten miles to the south on the Ohio River. The Hendersons called attention to Burr's plans and put in motion his arrest and indictment. As this historic event has a spatial connection, modeling the larger environment to reveal and interpret this story is an application of the 'regional' scale pointcloud. The designation of the plantation property (approximately 80 acres) as a nationally significant historic district relies on the spatial organization of the plantation landscape, a 'site' scale model, as a key component of the integrity of the property. Aerial LiDAR was collected of the entire landscape creating a model for analysis and revelation of previously undocumented forms, lines, and patterns. Landscape components that were documented in the aerial LiDAR include natural systems and features; spatial organization; land use; circulation; topography; vegetation; and archeological sites. Ground-based scans captured the 'buildings/structures' scale including the main Henderson Hall mansion, small scale features, as well as, a highly detailed model of the main structure's adjacent landscape. As new programming elements are proposed within the district, researchers are able to test management alternatives within the three-dimensional

environment of the model. Visualizing change assists researchers in communicating design and planning decisions and the impacts of those changes on the integrity of the district.

**Conclusion:** NRAC will continue to gather, process, and apply three-dimensional data to support environmental and heritage planning; archeological surveying and visualization/simulation efforts. Integrating aerial and ground-based LiDAR in constructing models fits the variety of scales that researchers and planners address in their work. As the Henderson Hall project progresses, demonstrating the interpretive potential of the model will become a key outcome of the project.