

Background

In 2009, the North Carolina 911 Board awarded a grant of \$12.3 million to the City of Durham's Emergency Communications Center for acquisition of statewide ortho imagery. The Durham PSAP concluded that a statewide project would maximize benefits in a timely way. The City of Durham requested help from the North Carolina Orthophotography Planning committee to assist with managing the collection of this Orthophotography. The North Carolina Geospatial & Technology Management Office (GTM) undertook the acquisition management of this project to obtain new natural color digital aerial orthophotography of all 53,819 square miles of North Carolina at a 0.5-foot pixel resolution in one flying season. The primary goal of the North Carolina Orthophotography Project (NCOP) is to fulfill base layer requirements for local, state and federal uses, such as emergency response, floodplain mapping, and tax assessment. Due to the amount of labor required to complete this project, GTM divided the state into four regions. GTM utilized two prime contractors to collect the imagery, assigning each contractor two of the four regions, and the contractors worked with subcontractors to ensure that all of the required aerial orthophotography could be gathered and processed within the tight timeframe.

The 2010 North Carolina Orthophotography Project (NCOP) began acquiring data in January of 2010. Because of the scope of the project, the use of digital aerial image sensors was required for image acquisition. In order to meet the project requirements and deliverable time frame, there were up to 26 possible planes that could have been used for the collection of the imagery. In NC it was required that all of the digital sensors meet the same standard criteria and that all acquisition contractors produce a product of the same quality.

Before digital aerial image sensors, film **mapping** cameras were calibrated and validated to specific standards set forth by USGS (<http://calval.cr.usgs.gov/osl/obtaining.php>). The existing USGS calibration laboratory could not be used to calibrate digital aerial image sensors because each manufacturer's digital aerial image sensor has its own unique imaging geometry based on its system components. USGS is currently in the process of developing a method to test digital sensors but that is not currently available.

The North Carolina Orthophotography Project (NCOP) was designed to leverage the advantage of the newer digital camera technology which allows for the simultaneous acquisition of both natural color and color infrared imagery. Two project teams were selected to acquire and process the digital imagery for this project; the teams' combined resources included 20 aircraft and digital cameras that could be used for imagery acquisition. In NC it is required that all of the sensors used produce a similar product of the same quality. Therefore, it was determined in the planning phases of the NCOP, that there should be an In Situ Validation Range (ISR) developed in North Carolina to test the sensors in-flight. The purpose of an ISR is to calibrate and/or validate aerial sensor systems and the orthophoto process methodology employed in North Carolina given its existing geospatial resources (LiDAR elevation data and GPS base station distribution). In the NCOP project the North Carolina ISR was used to validate the aerial sensor systems used for aerial acquisition. North Carolina Geodetic Survey (NCGS) and North Carolina Department of Transportation (Photogrammetry Unit) worked together to find an area that fulfilled the requirements posed by USGS to set up a camera calibration site in North Carolina. It was determined that NC did not have the terrain change necessary to fully create a USGS In Situ calibration range. However, based on the needs of aerial collection within the state a validation range would be a great asset for current and future collections from aerial

sensors. USGS Digital Aerial Imagery Calibration Range Requirements are available at http://calval.cr.usgs.gov/aerial/digital_qa/.

It was determined that the best location for the range would be in Surry county. This area was chosen for several reasons: terrain change over a distance, flights would not impede air traffic, and flights would not cause major issues to the local's security concerns. (For the NCOP project it was a required that Surry County be informed when the validation flights would occur so the county would know there would be up to 5 planes flying over their county in a short time frame.)

Recommendation

There is now a range set up in Surry County that has measurements around the airport. In order to produce the best possible validation each sensor should fly the entire area and produce an orthophoto for the tiles that fall within this area. It is the intent that all sensors be used to produce a final product to determine that the vendor follows best practices, utilizes sufficient process quality management techniques and implements comprehensive process change control to ensure that a clear understanding of project deliverables and that the final product meets project specifications. This gives the client a clear idea of what the vendor considers to be an excellent product. The orthophotos are then checked against the ground control measured in advance at the airport. NCGS performs this function for the state and can assist any local government who wishes to internally take on this task.

While the recommendation is to produce complete orthophotos for every sensor to be used in a project, it was not possible during the collection of the NCOP. The time needed for 14+ planes to acquire digital imagery, produce 8 orthophoto tiles for each of those planes and to have them all approved did not fit into the timeframe needed to collect the entire statewide orthophotography in one flying season. There was a compromise made for the NCOP. It was determined that each prime contractor produce a full orthophotography set of tiles. This deliverable would be evaluated to determine that each prime understood the scope of the project and could meet all project deliverable requirements. The remainder of the sensors flew only the eastern most block of tiles. The images were rectified to the NC LiDAR digital elevation model, but not produced to visual standards. These areas were not required to have color and contrast corrections. The major concern for this area was the horizontal accuracy of the collection. These tiles were tested by NC Geodetic for horizontal accuracy within the specifications of the project.

NC Geodetic survey is currently in talks with USGS to provide the Validation range as a national site which could be flown for sensor collections on the east coast.

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