

North Carolina Orthophotography Project Issue Paper 3: Team Coordination and Cooperation

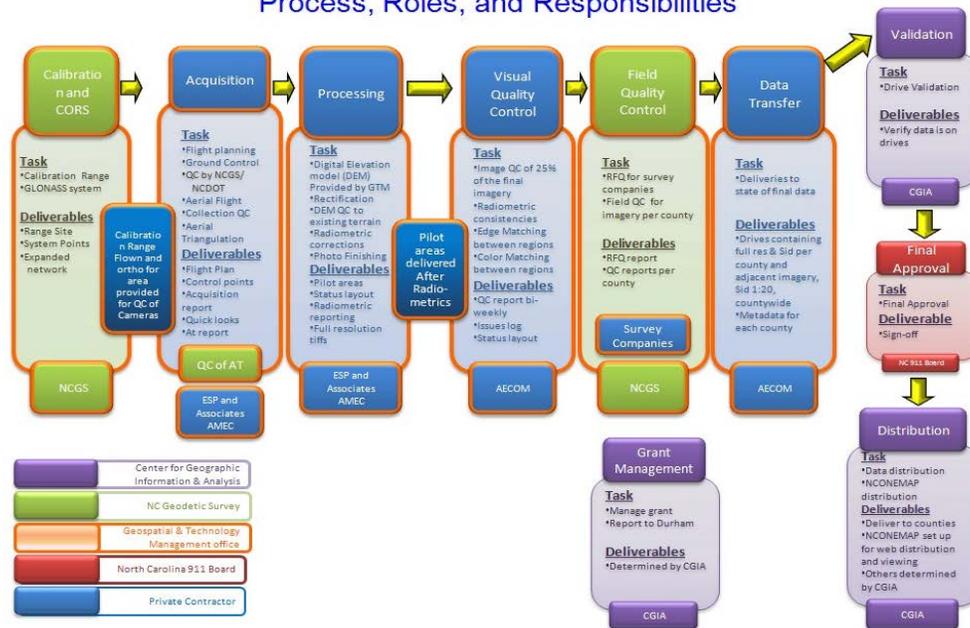
Background

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 working group within the State Mapping Advisory Council 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 for 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. Also included in this project was a validated quality control (QC) process to check the AT, QC for visual aspects of the imagery and QC for horizontal accuracy of the project. The collaboration on this project to deliver a seamless product in a year is a momentous task. Below we will discuss the process for coordinating the contractor teams required to collect this much information in one flying season.

ISSUES-State Role

The first issue was determining the process for collection and who would be responsible for what roles. GTM put forward this plan and suggested responsibilities for each of the roles. This was the process that was selected.

**2010 Statewide Orthophotography Project
Process, Roles, and Responsibilities**



Once the State roles were agreed upon, GTM determined the number of acquisition teams it would take to collect the amount of imagery needed for the state. It was decided that two prime engineering firms and four acquisition teams would be required to collect the imagery. The teams could then decide themselves what the roles of the acquisition teams would be responsible for and what amount of information would be collected and processed by each team.

The teams were asked to have additional subcontractors on board for capacity sake. If processing, AT, or finishing could not be completed by the acquisition teams, these other licensed survey companies would be on board to assist with the work load.

We also selected one prime and one acquisition team as the QC for the entire project. Because of the use of multiple contractors and the number of people involved we wanted an unbiased look at the final project deliverables.

GTM also worked ahead of time to determine: Flight requirements, Reporting formats, imagery requirements, Certifications and seals that would need to be provided, media necessary for delivery, file size limitations and drive size needs, etc.... These were important because of their future use for all imagery collection projects within the state.

Expectations

The second issue was to clearly define the expectations for the imagery to be delivered for the state. And to clearly define the roles that each group would be playing.

- Milestones for completion of defined sections
- Clear understanding of responsibilities
- Clear Expectations on what would and would not be corrected
- Consistent and regular communication, both internally among team members and externally between the teams

The Milestones for the project within the acquisition requirements were defined as follows:

1. Calibration and CORS- NC Geodetic Survey
 - a. This included the validation range (information provided in IP2),
 - b. Continuously Operating Reference Station (CORS),
2. Acquisition-
 - a. Flight plans were approved by the state group
 - b. Ground control for each section was also approved by the state
 - c. Teams determined how best to acquire there section
 - d. Communication between teams was expected so that all areas would be covered adequately without duplication of effort
3. AT/AT QC
 - a. AT coordinated by the acquisition teams. Either done in house or with the other licensed firms within the contract
4. Processing
 - a. There were two pilot areas for each region of the state. The state ortho committee attended meetings to approve the color and visual clarity of each of the pilot areas. This pilot was used to apply the color to the remainder of the region.
 - b. Communication was very important between the teams so that the final product would be seamless across the state. The teams worked with one another to provide information so that all teams could provide a tied product
5. Visual QC
 - a. All teams provided their products to the QC team. The visual QC team checked 25% of the state with a focus on Major urban, seams between the regions. QC in every county.
6. Field QC- coordinated through NC Geodetic Survey
 - a. Survey teams were sent to the field to collect survey for points in each county. The information was then compared to the imagery to check for horizontal accuracies
7. Data Transfer-
 - a. Transfer was controlled by the Visual QC team because all of the data was in their hands.
 - b. File structure was provided to the team.

Clear Expectations were delivered at the beginning of the project for what corrections would be required. Because of the scope of this project and the timeframe for which the delivery was to be concluded, expectations were defined as such.

Areas of great importance:

- Transportation
- Major Bridges
- Urban areas (to include lean)
- No buildings or large structure pieces cut with seam lines
- Areas of state importance (these areas will be provided)
- color and contrast well balanced at seam edges between contractors and mostly between primes

Areas of least importance

- Limited fixes in highly vegetated areas when all visual components are dense vegetation
- Limited cleaning of color or mosaic line issues in water bodies.
- No expectation of corrections to utility lines above the ground

Vendor Issues

Communication affected a number of technical issues, such as how images tie across the borders, how the teams would share information with each other, and how the teams would divide responsibilities along the common boundary.

To ensure that communication happened regularly and smoothly, the teams established protocols for communication and data sharing at the very beginning of the project, and adhered to these guidelines throughout the project term. Communication was effectively broken into three main phases:

1. Design Phase
2. Planning Phase
3. Execution Phase

Design Phase

Team members were already considering the process of establishing communication protocols prior to the project kickoff meeting, and were thus able to raise these issues for discussion at the project meeting. This early discussion focused on a collective review and understanding of the project specifications, division of labor, and the mechanics of working together.

The teams began the design phase by talking about and exchanging information on the project specifications. They discussed specific, technical issues so that a common baseline understanding for each project requirement existed. Individual team members would raise

specific items to ensure that all other team members understood them similarly. Following this process of evaluation of the team's understanding of each technical requirement, the teams sought feedback from the state on any issues for which they felt the need for clarification. Engaging the client where necessary became a means of establishing cooperation and communication.

Once a common understanding of the project requirements had been reached within the team and had been validated by the client, the teams moved on to discussing how best to allocate resources and take ownership of specific project tasks. For example, the AMEC Team was responsible for the Mountain and the Western Piedmont Regions of North Carolina. At the outset of the project, there was a need to clearly understand which of AMEC's two subcontractors was responsible for each geographic region. Through discussion during the design phase of the project, it was determined that the Sanborn Map Company, one of AMEC's two subcontractors, would take responsibility for the Mountain Region because their staff was the most familiar with the challenges of working in the mountains.

Once the work responsibilities had been divided geographically, the two teams discussed how each of their subcontractors would work together along the common border. The key to this process was to establish specific criteria for aerial flight lines to overlap so there would be no gaps in coverage. The teams also communicated during the ground control planning process, so that there would be sufficient control along the border without imposing control by two subcontractors within the same flight strip. The teams requested the state's tiling index from the NCFMP and meticulously reviewed the common border to assign ownership for tile production on a tile by tile basis. Flight lines were not finalized until responsibility for each tile was determined.

In both this phase and the following phase, each team extended its communication process to the other team. As with internal communications, these external communications including sharing information, sharing concepts and designs, achieving consensus on plans and responsibilities, and validating each other's plans. Although the two teams were originally assigned regions of the state based on a number of counties, it became apparent that the two teams could not simply divide responsibility for the state in half based on counties without duplicating flight lines and aerial imagery, because county boundaries at the center of North Carolina do not follow a straight line from north to south but instead zigzag back and forth around the state's longitudinal center line. Dividing the state in half at its center would divide some counties in half. To address these geographical constraints, the two teams agreed to a working border on a tile by tile basis rather than on a county boundary basis. This resulted in a very efficient design and plan. The two teams also established control locations by working together, so as to avoid duplication of efforts.

Planning Phase

The detailed communication and cooperation on the project continued during the project's planning phase. During the planning phase, the teams developed the project documentation, flight and control plans, tile indexes, and communication plans and protocols that were discussed during the design phase. The project plan was born out of the design for flight plans and the tile index where responsibility had been assigned for each tile. During the planning

phase, each subcontractor and each team checked each other's flight plans and ground control plans to ensure there was no duplication of effort or any gaps in coverage and control. The planning process was essentially a validation of the design phase. Communication during this phase involved refining procedures related to flight plans and control plans and continuing to exchange information as much as possible.

Execution Phase

The need for regular communication continued throughout the execution phase of the project. This involved weekly reporting on each subcontractor's and each Team's progress, so that the other Team and fellow subcontractors could adjust their work accordingly. This allowed the teams to adjust imagery and to share control ties along borders for each of the four regions, so that there was a satisfactory level of uniformity in both qualitative and quantitative requirements for the project. The original plan for the execution phase was that whichever subcontractor completed a common border first, the second subcontractor would be required to match their imagery to the imagery of the subcontractor that had already reached that border area. Communication of progress was thus central to an understanding of responsibilities during this phase.

However, while the Teams had used communication throughout the project to establish specific technical responsibilities, neither the Teams nor the NCFMP enjoyed 100 percent success in sharing information and data such that no communication or coordination lapses occurred during the project term. Up front, each Team had agreed to exchanging design and planning documents, but the exchange of information during the execution process was less successful than during the previous phases.

Recommendations

For the NCOP, the quality of the project deliverables was determined by communication and coordination during the project phases. During the planning and design phases of the project, the teams focused almost entirely on the technical aspects of collaboration, making the project technically successful. However, during the execution phase communication on progress was, at times, lacking from one team to another. This project highlighted the need to focus on a more formal infrastructure for establishing communications and milestones and understanding each other's progress. Although each team provided weekly reports, these reports were sometimes lacking the detail necessary to allow team to coordinate work as effectively as possible.

It is recommended that in the future, communication protocols are established for each phase of the project – design, planning and execution – at the very beginning of the project term. While sufficient protocols were in place for the design and planning phases of this project, communication sometimes broke down during the execution phase of the project. These protocols should include established milestones for communicating on each subcontractor's schedule and progress as well as predetermined deadlines for exchanging critical data so that imagery can be tied in appropriately. More attention should be paid to the non-technical aspects of collaboration: communication, reporting and oversight. Additionally, a clear point of contact for each subcontractor should be established, so that each team knows who to contact with

questions at any time. The prime contractors for each team should ultimately be held accountable for actively promoting and maintaining consistent and effective levels of coordination and communication between the teams, throughout the life of the project.

The following guidelines are recommended for each phase of the project and should be established during the project kickoff:

1. **Design Phase.** Communicate and collaborate among each team, across teams, and with the NCFMP in order to achieve:
 - a. An understanding of the project specifications shared by both project teams, each project subcontractor, and the NCFMP;
 - b. A geographic division of responsibilities agreed upon by all parties; and
 - c. Specific planning parameters, including established flight lines and assignment of production responsibilities on a tile level basis.
2. **Planning Phase.** Review of the design phase should occur such that:
 - a. Each subcontractor on a team evaluates the other subcontractor's flight plans and ground control plans to eliminate any possible duplication of effort and to identify any gaps in coverage or control; and
 - b. Each team evaluates the other team's flight plans and ground control plans to eliminate any possible duplication of effort and to identify any gaps in coverage or control.
3. **Execution Phase.** Communication protocols should be established, including:
 - a. A single point of contact for each subcontractor and each team who is able to provide details on that party's current progress at all times;
 - b. Each subcontractor should provide its team leadership with detailed weekly reporting on number of tiles for which imagery has been collected and processed;
 - c. Each team should provide the other team and the NCFMP with detailed weekly reporting on number of tiles for which imagery has been collected and processed;
 - d. Deadlines for exchanging information critical to tying in borders among subcontractors on each team as well as among the two teams; and
 - e. Deadlines for exchanging information related to schedule and progress updates for each subcontractor.

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