SPECIAL FINANCE COMMITTEE AGENDA
Monday, September 19, 2011 – 6:45 P.M.
Council Chambers – 1516 Church Street
[A quorum of the City Council may attend this meeting]

Discussion and Possible Action On:

1. Consideration and possible action on approving a contract with Access Geographic in the amount of $23,521 for aerial photography services throughout the City and surrounding area.

2. Adjournment.

Any person who has special needs while attending this meeting or needs agenda materials for this meeting should contact the City Clerk as soon as possible to ensure a reasonable accommodation can be made. The City Clerk can be reached by telephone at (715) 346-1569, TDD# 346-1556, or by mail at 1515 Strongs Avenue, Stevens Point, WI 54481.

Copies of ordinances, resolutions, reports and minutes of the committee meetings are on file at the office of the City Clerk for inspection during normal business hours from 7:30 A.M. to 4:00 P.M.

September 13, 2011

Stevens Point City Hall
1515 Strongs Avenue
Stevens Point, WI 54481

PROPOSAL: ORTHO IMAGERY PRODUCT – STEVENS POINT MUNICIPAL AREA, WISCONSIN

- PROJECT SPECIFICATIONS:
Area: Stevens Point Municipal Area (20 SQ MI)
Pixel Resolution: 3-inch
Camera: DiMac Digital Camera
Band: RGB (Natural Color)
DEM: Original Digital Surface Model
Control: 13 Surveyed Ground Controls
Accuracy: 1”=50’ NMAS

- PROJECT DELIVERABLES:
Deliverable: Seamless Ortho-Mosaic
Projection: State Plane / NAD83
Imagery Format: Uncompressed GeoTIFF / Mr.SID

[The client can expect deliverables within 6-7 weeks from the time both flight and control data are finalized and quality approved]

- PROJECT COST:
Total Cost: $23,521
[Total Cost includes shipping rate and HD]

[Payment Terms: The customer will pay the full amount of the Total Cost to Access Geographic on delivery of described order (Net 30 of delivery). Following Acceptance of the Order, any work completed before a cancellation of this order will be billed as services rendered]

Warranty, Limitation of Liability & Exclusive Remedy

Access Geographic warrants that the Services preformed and Deliverables provided by Access Geographic in this engagement shall conform in all material respects to the standards and specifications set out in this Proposal. IT IS EXPRESSELY UNDERSTOOD AND AGREED: THAT ACCESS GEOGRAPHIC, MAKES NO OTHER WARRANTY, EXPRESSED OR IMPLIED; AND THAT ACCESS GEOGRAPHIC, MAKES NO WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PURPOSE; AND THAT THE SOLE AND EXCLUSIVE REMEDY FOR ANY ALLEGED BREACH OF WARRANTY OR BREACH OF CONTRACT SHALL BE ACCESS GEOGRAPHIC'S REDO OF THE WORK OR REFUND OF THE PAYMENT AS ACCESS GEOGRAPHIC ELECTS. Without limiting the foregoing, it is also understood and agreed that: Access Geographic will not be liable for back charges for corrective construction work, engineering, or surveying resulting from alleged errors unless we have been notified in reasonably sufficient time to review and confirm the alleged defective condition and to assess and monitor the intended corrective action; and that if earth or other physical features have been moved within the mapping Project Area prior to notifying Access Geographic and permitting Access Geographic reasonable opportunity to observe the alleged mapping errors, Access Geographic will have no responsibility or liability whatsoever with regard to any professional services performed; Access Geographic's liability of any future claims relating to the services performed and materials delivered as part of this contract will be strictly limited to the total dollar value of the fees paid under this contract.

Timeline Restrictions:

This quote is only valid if executed no later than October 10, 2011 to reserve cost for leaf-off season scheduling.

ACCEPTANCE OF PROPOSAL:

____

Authorized Signature

____

Title

____

Date of Acceptance

STEVENS POINT PROJECT OVERVIEW:
ACQUISTION, ORTHO-PRODUCTION & QUALITY CONTROL

1.1. Aircraft and Crew Members

The aircraft charged with imagery acquisition for this project is staffed with an experienced flight crew. The aircraft is maintained and operated in accordance with regulations of the Federal Aviation Administration and the Civil Aeronautics Board. During the photo mission, crews navigate the aircraft by utilizing sophisticated flight management systems that control the flight pattern and camera system and support the navigation of the aircraft by producing accurate flight lines consistent with the TRACK 'AIR plan. This process ensures the optimum utility of all resources used in the photo mission and that accurate photography is acquired.

Camera annotation is computer-generated based on the flight plan and automatically associated with each exposure. This reduces photo lab work and enables the photogrammetrist to accurately determine the photo center projections to reduce ground control requirements and provide a strong aerotriangulation solution. The flight lines and photo center coordinates are digitized and loaded into the onboard computer for the entire project area. The digitized photo centers validates that the proper forward overlap and sidelap are maintained throughout the mission. The digital flight information is supplemented with visual confirmation by the camera operator using the prepared flight plan.

2. Sensor and Acquisition

A DiMac digital camera sensor will be utilitized for the project.

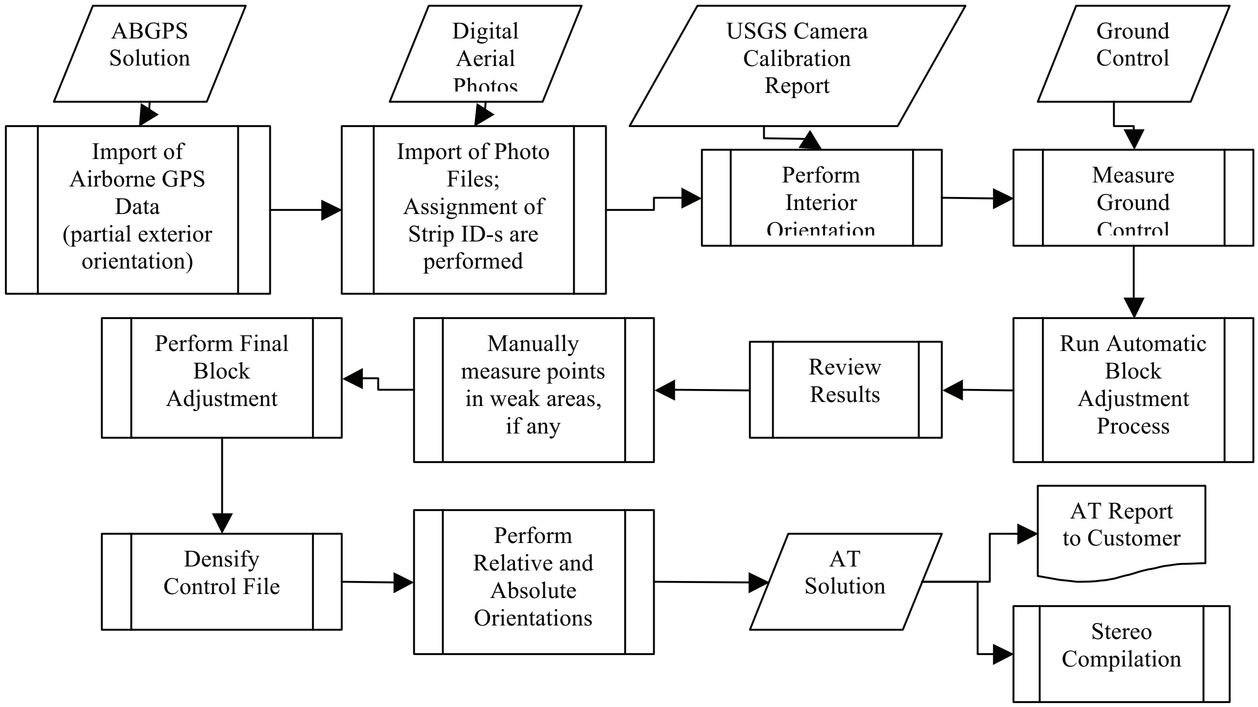
2.1. Atmospheric and Ground Conditions during Photography

Photography will be flown when the sun angle or elevation is not less than 30 degrees above the horizon. Photography will not be undertaken when the ground is obscured by snow, haze, fog, or dust; when streams are not within the normal banks; or when the clouds or cloud shadows will appear on any one photograph. The photographs will not contain objectionable shadows caused by relief or low solar altitude.

A thorough inspection of both the aircraft and camera will be conducted prior to each aerial photography flight mission. This inspection includes a check of each and every component of the camera to validate optimum working condition and to prevent any foreign particles from causing an issue.

3. Digital Aerial Triangulation

Digital Aerial Triangulation (DAT) is a digital photogrammetric process that accurately registers a block of aerial photography to the earth's surface and, in conjunction with the amount and accuracy of the ground control supplied, ultimately defines the accuracy of the digital mapping. Measurements are carried out on a softcopy photogrammetric workstation using the digital aerial photo images. We will use a largely automated but operator-assisted approach, using Intergraph's Image Station Automatic Triangulation (ISAT) software. The results of this method are statistically similar to that of traditional AT, but without the marked diapositives. Most importantly, the digital approach to aerial triangulation yields a tremendous time and cost savings that is passed directly to the customer. Our approach will generally follow the flow shown below:



To complete an accurate Aerial Triangulation (AT) adjustment, ground control points must be strategically located around the perimeter of the project with additional points placed throughout the interior of the project block.

The first step in the AT process is to import the Airborne GPS (preliminary Exterior Orientation) data, the digital aerial photos as well as information from the Camera Calibration report for the camera or cameras used to acquire the aerial imagery. All of these elements are stored in a "project file" within ISAT. Next, flight strip numbers (flight lines) are assigned, camera orientations are assigned (based on the direction of each flight line) and relationships between the aerial photos and the Airborne GPS data are established.

The next step is to measure the ground control into the AT project. This process is entirely manual. The operator imports the ground control coordinates into the project, then selects on the first point. The software drives the operator to the approximate location of that point, the operator measures the point into the center of the target that was placed during the control process. These steps are repeated until all project ground control points are measured into the project.

The next step involves performing the first of two block adjustments. This process automatically extracts image pass points and tie points. Pass points are coincident pixels between the overlap areas of adjacent frames of photography on the same flight line. The tie points are coincident pixels between the side-lap areas of adjacent frames of adjacent flight lines. Using ISAT, we are typically producing 75-100 pass and tie points per frame. This number of points is significantly higher than using a manual approach where an operator would measure in 9-15 points per frame. Using automation for the block adjustment turns a city-scale aerial triangulation effort into a weeklong process, rather than the 6-8 weeks it would take using manual methods.

The block adjustment process also performs a blunder detection. It isolates weak areas and displays those areas to the operator. The operator then inspects the weak areas, if any, to determine if a body of water causes the weakness, or if the program simply did not pick enough points to produce an accurate solution. If the later is found true, the operator will manually measure in the points necessary to complete an accurate solution.

Once the solution is believed to be acceptable, the final block adjustment is performed. The software performs as few as 9 and as many as 15 iterations of the final adjustment. It automatically removes points it has determined to be blunders in the solution and proceeds with the next iteration. At the end of this process, the operator examines the statistical outputs. If the statistical results are determined to be outside of the expected variance, a point-by-point investigation begins. The operator will sort all points the by a statistical value, and then begin removing the points with the highest degree of error. This step is repeated until the overall solution is within an acceptable tolerance to produce the required map accuracies.

The next to last step is called "control densification". During this process, the software writes all pass and tie image points to the project control file. This is when the large number of points generated by ISAT becomes a significant advantage to the overall project results. Not only can we feel comfortable that the degree of accuracy is very high due to the large number of image points (that are now control), but we can also use these points to statistically measure all subsequent mapping products (stereo compilation, digital orthos and final vector datasets).

3.1. QC Procedures

The AT adjustment process positively identifies any point that is out of tolerance with other values in the block. We can quickly determine if a point is out of tolerance due to survey error, a point coding error or a measurement error. These errors are detected during preliminary adjustments and corrected for the final adjustment.

Shoreline points are used to check for lake leveling, and for proper flow on large rivers. We graphically review the output of the AT software at the same time as analyzing the comprehensive statistics. This gives us the ability to quickly evaluate the results of the adjustment while simultaneously performing quality assurance of the block.

4. Stereo Compilation

Z/I (Intergraph) software for stereo compilation will be utilized for this project. These are the Z/I stereo compilation modules we will utilize for this project:

- Image Station Photogrammetry Manager (ISPM): This software will enable our team to set up a project and manage its various components.
- Image Station Stereo Display (ISSD): This software will enable the operators to view the stereo models in a 3D environment.
- Image Station Feature Collection (ISFC): This software will enable the operator to depict the feature to be captured in a Microstation environment and will act as an interface between the operator and Microstation
- Image Station DTM Collection (ISDC): This software will enable the operators to collect mass points and breaklines and code them properly. It will also allow our operators to generate TIN surfaces to be used in the ortho rectification process.
- Microstation: This software will be used for data capture purposes.

4.1. Surface Definitions

There is more than one means to properly define the surface. The surface definition type is often dependant on the final use or application of the data. The method we will employ for this project is the DSM (Digital Surface Model). This DSM will be created "on the fly" and will be used in the case the existing DEM is not usable. The DSM is a less rigorous definition of the Earth's surface than a DTM (Digital Terrain Model). A DSM is developed primarily to support the orthorectification. It is not intended for contour modeling but can be used in any TIN (Triangulated Irregular Network) or 3-D package to provide a general definition of land. A DSM is developed by photogrammetric technicians placing an irregular spaced mass points (those are discretely placed x, y & z locations on the Earth's surface). Where applicable, a photogrammetric technician will also place a breakline to further define the surface. A break line is a 3-D line discretely placed by the photogrammetrist. It is used to define a gradual or sharp break in the Earth's Terrain. Breaklines can be defined as a "hard surface" or "soft surface" breakline. Hard surface breaklines generally follow man-made features or along features that are definitive in the Earth's definition, like a river or a cliff. Soft surface breaklines generally model gradual slope in the Earth's surface. For a DSM, there are typically far more mass points than breaklines and the breaklines are generally placed only in areas that would be critical to the overall orthophoto solution.

4.2. DSM/DEM Quality Control

Three QC procedures are used to insure the accuracy of the DSM/DEM. The first is a quantitative analysis that compares the interpolated elevations of the photogrammetric pass point XY positions against the densified vertical control values that are the output of the aerial triangulation process. Secondly, on the completion of the collection by the line operator, the project supervisor will independently measure a sparse but statistically valid check grid, measuring checkpoints in clear, open ground. The XY positions of the check grid are interpolated into the produced surface model and the differences between the interpolated values and the check-measured values are analyzed to confirm compliance with the project specifications for the project. Should any model fail this test, it will be reset and additional stereo collection carried out until conformance is achieved. Thirdly, a qualitative analysis is also made by each operator by viewing the surface model to insure that the coverage is continuous and exceeds the block of data being rectified.

5. Digital Orthophotography

Z/I OrthoPro software is utilized for orthophotographic production. This software package not only represents a solid photogrammetric solution to producing orthos but it also integrates well within our Z/I production suite of software (ISAT for triangulation and MicroStation for stereo compilation). Our process will generally follow the following workflow:

We propose to rectify every frame throughout the project and use only the central portion (a.k.a. "sweet spot") of each image. We avoid using the portion of the imagery near the photo edge, where normally the greatest radiometric and relief distortion occurs. This will greatly minimize the relief displacement of above ground features such as buildings and bridges. Using every exposure also reduces the variation between images caused by the radiometric fall-off that occurs on the extreme edges of the photograph. As a result, both radiometry and image quality of the final orthophoto imagery is greatly improved.

We employ a cubic convolution algorithm to maintain image quality during the rectification process, resulting in a superior image quality when compared to nearest neighbor or bi-linear interpolation algorithm. The brightness value of each pixel calculated from a kernel of sixteen pixels in the scanned image. This process is repeated for each pixel to and calculates the true geographic position of each pixel within a scanned image to complete the orthophoto image.

Combining the orientation data and the DEM, the rectification software differentially re-samples the scanned image to create the digital orthophoto.

5.1. Mosaicking

On acceptance of each image-based tile, seamlines are created using a combination of automated and manual tools and then inspected by an operator. The tiles are mosaicked together along the seamlines to produce the seamless ortho image required.

The orthophoto imagery shall conform to the quality standards set out in our Orthophoto Acceptance Criteria (OAC). This document defines what our internal standards for creation of acceptable orthophoto imagery in relation to the mapping or viewing scale within the scope of this project, the digital orthophoto product shall be checked against the OAC to ensure that it meets the requirements for georeferencing; radiometric tone balancing; mosaic joins; image degradation due to hairs, blemishes, or radical elevation changes in the DEM; and file format and naming convention. Copies of our Ortho Acceptance Criteria as well as our Quality Assurance Program Plan (QAPP) are available upon request.

5.2. Radiometric Adjustment

The mosaicked image created in the previous step is inspected for both image quality and consistent radiometric quality. Adjacent image tiles are also inspected to ensure the continuity of roads and other features. We initially adjust the radiometric values of a block of ortho images to ensure a consistency of tonal range. Building rooflines that could otherwise have been located on the edge of butt joined ortho tiles with different orientations will not be disturbed. If additional radiometric adjustments are necessary, we bring the entire set of orthophotos into INPHO's OrthoVista software. OrthoVista is the industry leading software for color balancing. In that software, you can establish trends and bring a series of points to a consistent tone.

The final process is to cut the continuous seamless image in to the delivery tile format approved by the client. These tiles then undergo a final QC review prior to shipment.