15 April, 2009

State of Idaho Technical Working Group

RE: Possible additional data options for 2009 Idaho NAIP

Background

Surdex has been selected by the USDA Aerial Photography Field Office (APFO) with acquiring and processing imagery for the 2009 National Agriculture Imagery Program (NAIP). Surdex was also selected for the states of Utah and New Mexico.

This memorandum is meant to alert you to possible additional data options available through Surdex. There is no immediate action required by the State of Idaho. The options involve work that does not interfere with the execution of the NAIP effort on behalf of the USDA. As per standard contract conditions between the USDA and Surdex, no additional effort can be undertaken until Surdex satisfies all deliverables for the NAIP for all of the Surdex state project areas. Thus, delivery of any optional data would not take place until late 2009 or early 2010.

Project Scope

The 2009 NAIP effort for the State of Idaho entails:

1. Acquisition of the entire state at 1-meter resolution or better with a digital camera.
    a. Season acquisition window of 10 June through 15 August.
    b. A non-contractual preference has been stated to acquire data in a north-to-south direction.
    c. Acquisition with a digital camera. Surdex uses the Intergraph Digital Mapping Camera (DMC), a large-format frame camera. This multispectral camera simultaneously captures panchromatic, color (red, green, and blue), and near infrared imagery.
    d. All exposures will be captured using one of Surdex's three DMCs, each hosted in a twin-turbine Cessna 441 (Conquest) aircraft capable of altitudes up to 35,000' MSL.
    e. Preliminary flight plans indicate that approximately 9,000 exposures will be required. Plans include full stereoscopic coverage with overlaps of 60% forward and a minimum of 30% sidelap. Image resolution will be 1 meter or finer for all exposures.
2. Production of uncompressed 6,553 DOQQs at 1-meter resolution, 8 bits/pixel depth, and 4 bands (red, green, blue, and near infra-red).
3. Production of 44 natural color Compressed County Mosaics (CCMs) at 1-meter resolution in JPEG2000 format.
4. Production of a seamline shape file for each CCM delineating the exposure date of each pixel.
5. An absolute accuracy requirement of 6 meters, 95% confidence level. The elevation model will be based on the most current version of the USGS National Elevation Dataset (NED).

Additional Data Options

Surdex is also willing, at a moderate additional cost, to deliver a seamless mosaic of orthorectified 4-band imagery and/or separate layers of color and color infrared (CIR) that covers the entire state. The seamless mosaic is comprised of 8,192 x 8,192 x 4-band GeoTIFF files. The mosaic is used during production and each DOQQ is extracted for delivery to the USDA. The advantage of this is mosaic is its seamless

characteristic, which requires ~25% less storage with no overlap characterized by the DOQQ format (which includes at least 300 meters of over-edge on all sides). It is the most suitable mechanism for web-serving of data. Additionally, this can be delivered with internal "image pyramids" recognized by most common GIS packages (notably, ESRI products) and will accelerate the image display and most data access and loading.

For users requiring, or desiring, only natural color or CIR products, this seamless mosaic can be augmented by delivery of the tiles in separate color and CIR format. These tiles can also be compressed using YCbCr JPEG-in-GeoTIFF format, yielding a reduction of ~5:1 over the uncompressed DOQQs. This efficient TIFF 6.0-compliant color coding scheme results in a nearly lossless product at a very good compression rate. This "Y compression" is well-supported by numerous GIS software applications, including ArcMap, ESRI ImageServer, and ArcSDE. Differences between uncompressed and compressed data in this format are characterized by random variations of ±2 intensity levels.

The following table presents the options and some details based on a preliminary analysis. Information pertaining to the DOQQs is supplied for reference purposes only. As per contractual obligations, this data can only be supplied by the USDA. Compressed quantities are based on average values based on past experience and may differ.

Item	Quantity	Approximate Storage (GB)	Storage Gain (vs DOQQs)
Uncompressed 4-band DOQQs	6,553	1,100	
Seamless tiles, GeoTIFF format	3,600		
Uncompressed 4-band		880	20% / 1.25:1
Uncompressed 4-band with pyramids		1,200	-6% / 0.94:1
Uncompressed color or CIR (each)		660	40% / 1.67:1
Uncompressed color or CIR with pyramids (each)		880	20% / 1.25:1
Compressed color or CIR with pyramids (each)		220	80% / 5.02:1

As an example, if a user is only interested in separate color and/or CIR imagery of compressed seamless tiles for the entire state, the storage requirement for the entire state would be 220GB + 220GB, or ~440GB total. In other words, by dealing with two separate layers of compressed data with pyramids, a savings of 60% (2.5:1) is realized compared to the uncompressed DOQQs.

Additional Software Options

Since some users may be interested in different types of tile layouts in different reference frames, Surdex is also willing to offer suitable re-projection software for use by the State. Examples are creating data in PLSS (Public Land Survey System) projects in units of US Survey Feet, typified by township and/or section tiles. This software is integrated with the seamless data set and can be "programmed" with minimal effort to create value-added products definable by most any ESRI projection file (".prj").

This software, the "OrthoDB" software, was utilized by the Washington State Department of Natural Resources (WA DNR) using a seamless data set re-processed to 18" (~0.5 meter) based on re-scanned film from the 2006 NAIP effort. The WA DNR was able to create multiple tile schemes for a variety of investors in the State using their own resources. A point of contact reference can be supplied upon demand of the State of Idaho wishes to explore this option further.

The software would be supplied under a standard software agreement. It operates on the Windows operating system and takes advantage of multiple processors for optimum computing. The software would be bundled with the seamless mosaic data set and can include pre-defined projections and tile schemes coordinated with the State.

Additional software supplied with this provides the ability to further process the tiles in additional form or format, including but not limited to:

1. Converting 4-band imagery to separate color or CIR.
2. Compress and/or uncompress imagery.
3. Creation of internal or external pyramid files – to existing or new imagery files.
4. Conversion to/from TFW and GeoTIFF format.
5. Conversion to/from tiled or striped TIFF files.

Follow Up

Should any, or all, of these options be of interest to the State, Surdex will generate a cost schedule for review. Given the delivery schedule gated by the contractual conditions, it can be funded with Fiscal Year 2010 dollars.

Please feel free to contact me at any time to discuss the provided information.

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