To serve our nation’s (and the world’s) spatial data infrastructure for the 21st century, we need authoritative topographic maps. Authoritative maps refer to high definition maps produced through a combination of hyper-accurate imaging, nuanced post-processing and color matching, exacting geo-referencing, and assured curation. The W.E. Upjohn Center for the Study of Geographical Change has invented the authoritative digital topographic map. The first tranche of these authoritative topographic maps is described below. Although at nominal 1:24,000 (1 in. = 2,000 ft.) scale, these maps can be used with digital ortho-images (such as NAIP) and retain their geometric accuracy to at least 1:6,000 (1 in. = 500 ft.) scale. Our authoritative topographic maps tile together seamlessly, are produced in several map projections, and can be used easily with Google Earth (or other earth viewers), or integrated into Geographic Information Systems. For illustration, please see the accompanying downloadable jumbo postcard .pdf showing Flint, Michigan’s “Buicktown” on a 2009 NAIP image, a “current” USGS 24k map, and a 60 percent transparency overlay of the map on the image.

Other Tranches. We believe our Authoritative U.S. Topos© should include other tranches that conform to the same high definition standard of accuracy, readability, and usability in contemporary digital settings. Thus, we intend to include in this series historic topographic map series such as: 1) Maps of America West of the 100th Meridian (the so-called “General Wheeler” maps); 2) the U.S. Army Corps of Engineers topographic maps (including precursor agencies); 3) U.S. Coast & Geodetic Survey (or successor agencies) maps; 4) Bureau of Land Management maps; 5) historic U.S.G.S. maps; and 6) maps issued by other agencies such as the National Park Service. We are making good progress on these next tranches.

The goal of the Authoritative U.S. Topos© series is to capture all officially released topographic maps of the United States as far back as Thomas Jefferson’s time. Thus, these tranches will constitute a time-and-space-integrated coordinate “clothesline” of the United States, populated with the very best map information for 21st century map users and analysts. Moreover, since many “maps” continue to be made without coordinates, these coordinate-free drawings may be snapped to our high definition reference maps for analytical use. The template for Authoritative U.S. Topos© can be used to create authoritative topographic maps for any nation’s mapping heritage.

An Extensible Development Path. Because the world of digital maps and spatial analysis is evolving rapidly, we have envisioned a common development path for each tranche -- leading from superb raster maps to fully vectorized maps readily usable on mobile computing devices. These maps can also be used by people with various visual impairments.

Tranche One. The first tranche of the Authoritative U.S. Topos© series covers the entire United States. It is a re-issue of the last paper topographic maps issued by the USGS (ca. 57,000 sheets). The USGS originally digitalized these topographic quadrangles in the early 1990s. This project proved the great value and feasibility of integrating digital maps into GIS applications. These digital maps “provided the blueprint for the development of much of the nation and provided critical information for development of our natural resources” [D. Cowen et al., “The Changing Geospatial Landscape”, NGAC 2009, p. 7]. Although widely accepted and still used, the digital versions of those maps (digital raster graphics, or DRGs) have been “showing their age” for some time. They have accuracy and visual quality (readability) problems. They were not publication quality because that was not possible in the 1990s. For the 21st century there is
compelling need to supersede these maps with digital maps of superb quality and accuracy. Our authoritative digital maps mirror for the first time the truly superb work done by USGS cartographers. This first tranche of these digital maps allows readers to see each map afresh, as if for the first time.

Our Solution. Our ultimate digital version of the USGS topographic map will soon be reality. Using ultra-accurate high-resolution scanners designed expressly for The W.E. Upjohn Center for the Study of Geographical Change at Western Michigan University, “Super-DRGs” of ultimate fidelity and accuracy are being created for the entire nation. (See examples below and in accompanying graphic of Flint, MI.) The extreme accuracy of the imaging process generates almost no non-map error in the Super-DRG. They are essentially digital facsimiles of the original maps. Super-DRGs are not just another “good enough” digital reproduction. The very tiny positional error generated in the conversion process (<.0001”, or <2.1 inches on the ground for a 1:24,000 scale map) means these maps retain only the error designed into them by USGS professionals – that is, map projection error and minuscule operator error. (We also use a completely non-destructive way of imaging rare and delicate maps.)

The Super-DRG (like the predecessor DRGs) is 8-bit color and 250 dpi resolution. Contours do not fuse together in areas of high relief, line work is crisp, text and symbols are highly readable, and color masks are evenly toned. The W.E. Upjohn Center has scanned and geo-referenced all 57,000 of USGS’s 1:24,000 (current) topographic quadrangles.

The W.E. Upjohn Center. Founded in 2006 by a generous private gift, The W.E. Upjohn Center’s principal mission is to convert historic large-format maps and aerial photographs from the pre-digital age into digital form. They then can be used in GIS studies modeling both spatial and temporal dimensions. Part of the University’s College of Arts & Sciences, the Center is a non-profit entity, requiring reimbursement for its activities. It preserves collections as digital archives, creates reader access files easier to read and much smaller than archival files, and re-purposes map and aerial photograph collections for the GIS/geospatial age. We are moving increasingly towards an assured curation model.

The Center also has invoked several exemplar initiatives because of their importance to its mission, only one of which is transmuting USGS topographic maps into Super-DRGs. These Super-DRGs provide coordinate referencing for historic maps, drawings, and aerial photos. The Center possesses the most accurate large-format map imaging capability worldwide. It is fully configured with GIS and other software, and maintains 157 TB of loss-proof digital storage. The Center also is a high-security, climate-controlled facility with an integral ultra-secure, climate-controlled archive with dry-fire suppression. The Center’s imaging equipment was designed expressly to image large format maps and aerial photographs. It possesses exclusive rights to its scanning equipment in the United States.

The Center may work with any public or private, domestic or foreign partner. We are catholic in our willingness to work with all funding models.

Benefits of Authoritative Digital Maps. Significant advantages accrue by having high quality Super-DRGs for use in reports and publications as well as in GIS. Our Super-DRGs are publication quality.
They are spatially accurate (accuracy of GIS is perhaps the “elephant in the living room” of the geospatial industries for the 21st century). Our digital maps are geo-referenced near-facsimiles. They display properly the “brand” for which the USGS (or other issuing agencies) are justly famous, and for which we have great respect. [National Academy of Sciences, “A Research Agenda for Geographic Information Science at the United States Geological Survey”, 2007.] Super-DRGs of this accuracy will never be eclipsed by new versions of them. The paper maps will not have to be re-imaged again in future. Geospatially-enabled authoritative topographic maps create a synoptic view of the world that has been becoming increasingly important since the beginning of the “Anthropocene Age”.

Super-DRGs provide an invaluable historical “snapshot” of places. Studies of geographical/location-based change are thereby enabled. This is true regardless whether users are planners and economic developers, environmental and global change scientists, historians and genealogists, surveyors and engineers, or citizens and students. Geographical change analysis using digital geospatial technology is increasingly important. It doesn’t matter whether one is a policy analyst or a global change scientist, an economic developer/investor or a “6th mass extinction” analyst. Change is constant in modern life. It doesn’t matter whether one lives in Indiana or India, Chattanooga or China. Our authoritative digital maps are designed explicitly for visualizing geographic/locational/place change.

Users benefit from accessing these digital maps regardless whether the sponsor is a public or private agency. Google Earth has demonstrated the transparency that comes from serving satellite image and digital map materials freely. It has also shown what was, until 2005, a worldwide latent demand for high-quality, easy-to-use earth viewing-and-mapping. Together with other Internet-enabled technologies Google Earth, Bing Maps (and others) provide citizens for the first time a synoptic view of regions they value. These geospatial viewers and databases are key to engendering democracy and transparency in government and private spheres. Our authoritative Super-DRGs contribute to more effective infrastructure asset management, coherent infrastructure planning, and economic development and sustainable environmental initiatives. They benefit both rural and urban America. They support homeland security and other government efforts. They benefit all imaginable constituencies across the country. They support more effective ecological analysis, planning, and management. In short, making these digital maps publicly accessible is a “win-win” strategy for society.

Timing. Tranche One will be complete in 2012. Other tranches are being pursued, and other authoritative map initiatives may be taken up -- depending on affirmation, funding, and partnerships with consortia, or public and private agencies. We welcome inquiries, encouragement, and dialog from and with all interested persons and entities.

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2/14/12