The Illinois Height Modernization Program: Improving Elevation Data for Illinois

Bev Herzog and Sheen Beaverson

Illinois State Geological Survey
Institute for Natural Resource Sustainability
University of Illinois
Height Matters: Transportation

- Transportation
- Mapping and Charting
- Construction, Engineering
- Recover decimated control networks

Slide courtesy of NGS
Height Matters: Flooding

Flooding: river overflow, coastal, storm surge, flash flood

- Determining High Water Marks
- Evacuation Route Surveys
- Damage Mitigation

FEMA Map
- Flood Insurance Rate Maps
- Elevation Certificates
- FEMA Cooperative Technical States, e.g. NC

Slide courtesy of NGS
Height Matters: Water Resource Management

- Dam Safety
- Water resources
- Relating tidal and geodetic datums
  - Ship transport: underwater/overhead clearance

Slide courtesy of NGS
Participating and Interested States

Current Funded Partners

States engaged in HM without federal funding assistance

Spatial Reference Centers
Regional Leaders
Other funded partners
## Height Modernization Appropriations

<table>
<thead>
<tr>
<th>Fiscal Year</th>
<th>Appropriations</th>
<th>States</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY 2001</td>
<td>2.25 M</td>
<td>CA, NC</td>
</tr>
<tr>
<td>FY 2002</td>
<td>3.75 M</td>
<td>CA, NC, LA, WI</td>
</tr>
<tr>
<td>FY 2003</td>
<td>3.75 M</td>
<td>CA, NC, LA, WI, MS</td>
</tr>
<tr>
<td>FY 2004</td>
<td>9.0 M</td>
<td>CA, NC, LA, WI, MS, AL, WA, SC</td>
</tr>
<tr>
<td>FY 2005</td>
<td>9.6 M</td>
<td>CA, NC, LA, WI, MS, AL, WA, TX, KY</td>
</tr>
<tr>
<td>FY 2006</td>
<td>9.9 M</td>
<td>CA, NC, WI, MS, AL, SC, TX, KY, AZ</td>
</tr>
<tr>
<td>FY 2007</td>
<td>9.9 M</td>
<td>“without direction”</td>
</tr>
<tr>
<td>FY 2008</td>
<td>4.995 M + 1.152 M</td>
<td>Line + AL, KY, IL</td>
</tr>
<tr>
<td>FY 2009</td>
<td>$2.54 M + 9.06 M</td>
<td>Line + earmarks (AL, MS, LA, IL, WI)</td>
</tr>
</tbody>
</table>
ILHMP Project Participants

- Illinois State Geological Survey
  – Beverly Herzog, Co-Principal Investigator
  – Donald Luman
  – Christopher Stohr
  – Sheena Beaverson

- Illinois Department of Transportation
  – Amy Eller, Co-Principal Investigator
  – Michael Blumhoff
ILHMP Steering Committee

- National Geodetic Survey
- US Geological Survey
- IDNR Office of Water Resources
- IL Professional Land Surveyors Association
- Illinois State Water Survey
Project Goals

• Establish a datum-consistent vertical and horizontal statewide network of survey benchmarks.

• Acquire a high-resolution digital elevation model (DEM) of the earth’s surface based upon that network.
Need for Height Modernization: Benchmarks

• Illinois Benchmarks
  – Illinois in bottom 10 states for height information.
  – Nearly half of all known benchmarks destroyed.

• Illinois datums
  – Multiple datums in use.
  – Stream gage datums
    – Memphis, Mean Gulf Level, 1912, and 1929.
    – Adjustments to NAVD88 are significant and complex.
Need for Height Modernization: Benchmarks

- **NGS Benchmarks**
  - Benchmark condition
    - Red: good condition
    - Blue: no reported recovery

- **IDOT Benchmarks**
  - about 56% survive
Need for Height Modernization: DEM Data

• Digital Elevation Model (DEM) Data
  – Few counties have data.
  – Data sets large, complex.
  – No statewide collection.
  – Unique parameters.
  • Differences at county lines.
  – Reluctance by counties to share data.
Project Activities

- Information survey Northern Illinois University
- Run level lines in northern Illinois
- Acquire available LiDAR and DEM data
- Develop project web site
Project Activities: Survey

• NIU Survey of existing information and data
  – Benchmarks
    • Condition
    • Datum
    • Known discrepancies
    • Current and proposed work
  – LIDAR data
    • Availability
    • Standards
    • Current and proposed work data acquisition
Project Activities: Survey

2008 Height Modernization
Data Acquisition and Usage

Please use the ‘Next’ and ‘Previous’ buttons at the bottom of each page to navigate through the survey.

The State of Illinois, under the leadership of the Illinois State Geological Survey at the University of Illinois and the Illinois Department of Transportation, has recently been accepted into the Height Modernization Program of the National Geodetic Survey.

The primary goals of the Illinois Height Modernization Program are:
(1) to establish a datum consistent vertical and horizontal statewide network of survey benchmarks, and
(2) to develop a high resolution digital elevation model (DEM) derived from LiDAR data,
To best use this federal funding and avoid duplication of efforts, we ask you to share information on what data you possess and/or plan to collect in the foreseeable future.

Thank you for your participation in this important endeavor.

- I am involved with geodetic survey data
- I am involved with LiDAR data
- My organization has plans to obtain LiDAR
- I am involved with both geodetic survey and LiDAR data
- I am not at all knowledgeable about geodetic survey or LiDAR

Please select the category that best represents your involvement in the collection and/or use of data.
Project Activities: Survey

• NIU Survey of existing information and data
  ─ Benchmarks and geodetic data returned for:
    • 79 Municipalities
    • 61 Counties
    • 5 Watersheds
    • 6 States
  ─ LIDAR data acquisition
    • 23 Municipalities
    • 17 Counties
Project Activities: Benchmarks

- Tie to Wisconsin, Iowa and Indiana lines.
  - Benchmark installation and leveling work tied to Winnebago County datum.
  - Tie Winnebago County line to DuPage County benchmarks.
  - Installed 24 new benchmarks
  - Completed a 47-mile line
Project Activities: Benchmarks
Project Activities: Year 2 Benchmarks

• Tie to Wisconsin, Iowa and Indiana lines.
  – Negotiating contracts for three level lines, totaling 142 miles
  – Will cover from Lake to Boone County
  – Will connect Lake Co to Year 1 line
Benefits of LiDAR: Lake County
Benefits of LiDAR: Winnebago Co.

Winnebago County: Pecatonica River, 2 miles east of Harrison, IL
Benefits of LiDAR: Will County
Project Activities: LiDAR

• Acquire available LiDAR and DEM data
  – IDOT Data Available for Download
    • Carroll: DAT, DGN, TIN, First Return, Bare Earth
    • JoDaviess: DAT, DGN, TIN, First Return, Bare Earth
    • Lee: DAT, DGN, TIN, First Return, Bare Earth
    • Stephenson: DAT, DGN, TIN, First Return, Bare Earth
    • Whiteside: DAT, DGN, TIN, First Return, Bare Earth
  – USGS Data Available for Download
    • Boone: ArcGrids, 2-Foot Contours, Bare Earth, All Returns
    • Winnebago: ArcGrids, 2-Foot Contours, Bare Earth, All Returns
Project Activities: LiDAR

• Acquire available LiDAR and DEM data
  – Data from USGS, ASACE, IDNR, & 4 counties undergoing archival procedures
    • Champaign: Bare Earth, All Returns, Breaklines, Contours
    • Grundy: Bare Earth, All Returns, Breaklines, Contours
    • Kane: Bare Earth, All Returns, Breaklines, Contours
    • McHenry: Bare Earth, All Returns, Breaklines, Contours
    • Will: XYZ, DGN, Metadata for Survey Points and Contours
  – Delivery not started
    • Henry, Ogle, Rock Island
  – Contract let, but data not acquired
    • Adams
Project Activities: LiDAR
Project Activities: LiDAR

• Acquisition Plans
  – HM Program: Kendall County this year
  – IDOT
    • District 4 has funds in hand
    • Districts 5 & 7 have plans to start within 2 years
Project Activities: Data Access

The Illinois Natural Resources Geospatial Data Clearinghouse, Illinois - Microsoft Internet Explorer provided by ISGS

A gateway to Illinois GIS data sets and orthoimagery.

Access Illinois GIS data sets and documentation (metadata) for ArcIMS Interactive Map Services, USGS digital topographic maps, aerial photography, orthoimagery, orthophotography, geology, land use, natural resources, and infrastructure. Illinois data sets and map data layers are available for download free of charge.

What's New?
- Illinois Height Modernization Program data on-line
  02/02/10 Lee and Whiteside
  12/09 Carroll, Jodavies, and Stephenson
  10/09 Boone and Winnebago
- RFP 1MKG028: open contract for LiDAR Acquisition for Kendall County

Software Tools
ArcIMS to GIS: load services directly into GIS software.
DownThemAll! tool for Firefox to download .zip files.
Expressview Browser Plugin (MSI) for Windows to view .sid files.

ArcIMS Interactive Map Services
- 2005 Chicago Urban Area Orthoimagery
- 2005 Illinois Digital Orthophoto Quadrangle Data
- 1998 Illinois Digital Orthophoto Quadrangle Data
- 1938-1941 Illinois Historical Aerial Photography
- Illinois Base Data: project info
- ISGS Illinois Natural Gamma-Ray Logs: project info
- ISGS Illinois Oil and Gas Resources: project info
- ISGS Illinois Water and Related Wells: project info

Available for download: ISGS Wells and Borings Points

history • milestones • project support

Illinois State Geological Survey
Institute of Natural Resource Sustainability
University of Illinois at Urbana-Champaign
Project Activities: Data Access

Illinois Natural Resources Geospatial Data Clearinghouse

Illinois Height Modernization Program (ILHMP)

Height Modernization is the establishment of accurate, reliable heights using global positioning satellite (GPS) technology in conjunction with traditional leveling, gravity, and modern remote sensing. Common program elements include:

- Benchmark installation, to replace those destroyed or to densify the network.
- Continuously Operating Reference System (CORS) installation. CORS receive GPS signals to provide real-time location corrections.
- Creation of a high-resolution digital elevation model of the earth’s surface using remote sensing technologies.

Height Modernization provides long-term benefits for the environment, helps to prevent loss of life and property estimates, and saves money. See our Flyer on Height Modernization for Illinois.

Program Overview and Project Milestones

- Benchmarks, Datum, and Leveling Efforts
  - Year 1 established 1 baseline, map provided by Patrick Engineering, Inc.
  - Year 2 will establish 3 line lines, map provided by Patrick Engineering, Inc.

- Monuments, CORS, and RTK Networks

- Illinois Digital Elevation Data
  Access elevation data for Boone, Carroll, JoDaviess, Lee, Stephenson, Will, and Winnebago Counties.

  If you download data, please send a screen shot of a derivative product created by your group, along with a 1 paragraph description of your project. We would like to create a gallery of how LIDAR data are being used in Illinois. Contact S. Beaverson

Project Steering Committee and Affiliated Agencies


Project Funding

The ISGS received nearly $300,000 to fund Year 1 project activities with assistance from Congressman Timothy Johnson through the NGS Height Modernization Program.

The ISGS received nearly $275,000 to fund Year 2 project activities through the NGS Height Modernization Program, championed by Congressman Timothy Johnson and Raymond LaHood, Congressmen Aaron Schock.

The ISGS anticipates receipt of about $792,000 to fund Year 3 project activities through the NGS Height Modernization Program, championed by Congressman Timothy Johnson and Congressmen Aaron Schock.

History • Milestones • Project Support

Illinois State Geological Survey
Institute of Natural Resource Sustainability
University of Illinois at Urbana-Champaign
Project Activities: Data Access

Data Delivery: Complete

**ALERT:** Data collections for Boone County are now accessible. Files are bundled into N-S flightlines, or groups of flightlines; there are either 33 flightlines or 8 groups of flightlines for each data type. Your feedback is appreciated. Can you deal with file bundles up to 600 Megabytes in size? Email [S_Beaverson](mailto:SBeaderson) with your comments.

**Boone County: Sanborn Mapping**

- Metadata
- AGPS IMU for Boone_Winnebago (.txt)
- Data Index (shapefile)
- Data Index (dxf)

<table>
<thead>
<tr>
<th>Data Type</th>
<th>Total GB</th>
<th>Zip File Bundle Ave. Size</th>
<th>Number of Files</th>
</tr>
</thead>
<tbody>
<tr>
<td>ArcGrids</td>
<td>1.25</td>
<td>120 MB</td>
<td>16,360 files, 2,045 folders</td>
</tr>
<tr>
<td>Contours, 2 Foot</td>
<td>2.48</td>
<td>140 MB</td>
<td>8,177 files</td>
</tr>
<tr>
<td>ENZ Files - Bare Earth</td>
<td>15.80</td>
<td>655 MB</td>
<td>2,045 files</td>
</tr>
<tr>
<td>LAS Files - All Returns</td>
<td>37.90</td>
<td>450 MB</td>
<td>2,045 files</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Data Type</th>
<th>8180</th>
<th>8200to8280</th>
<th>8300to8380</th>
<th>8400to8480</th>
<th>8500to8580</th>
<th>8600to8680</th>
<th>8700to8780</th>
<th>8800to8820</th>
</tr>
</thead>
<tbody>
<tr>
<td>ArcGrids</td>
<td>8180</td>
<td>8200to8280</td>
<td>8300to8380</td>
<td>8400to8480</td>
<td>8500to8580</td>
<td>8600to8680</td>
<td>8700to8780</td>
<td>8800to8880</td>
</tr>
<tr>
<td>Contours, 2 Foot</td>
<td>8180</td>
<td>8200to8280</td>
<td>8300to8380</td>
<td>8400to8480</td>
<td>8500to8580</td>
<td>8600to8680</td>
<td>8700to8780</td>
<td>8800to8880</td>
</tr>
<tr>
<td>ENZ Files - Bare Earth</td>
<td>8180</td>
<td>8200to8280</td>
<td>8300to8380</td>
<td>8400to8480</td>
<td>8500to8580</td>
<td>8600to8680</td>
<td>8700to8780</td>
<td>8800to8880</td>
</tr>
<tr>
<td>LAS Files - All Returns</td>
<td>8180</td>
<td>02458</td>
<td>02458</td>
<td>02458</td>
<td>02458</td>
<td>02458</td>
<td>02458</td>
<td>02458</td>
</tr>
</tbody>
</table>

**Winnebago County: Sanborn Mapping**
Project Activities: Data Access

Land Survey Monuments in Illinois

- NGS Datasheet Page
  - Find a Survey Mark

USGS Survey Benchmark Information
- Not yet available on the Internet.

- GeoCaching Benchmark Benchmark Hunting
  - Geocachers track down and photograph benchmarks; search by zip code or Point ID.

- HubTack, Inc. Survey Records On-Line
  - Includes Illinois monument records, OLO Notes, OLO Plans, and County Survey records.

- DuPage County Geodetic Control Resources
  - DuPage County, Illinois Geodetic Vertical Control Network Map

- Kane County Geodetic Monuments

- Aurora, IL City Benchmarks
  - Aurora City Benchmarks (Map and all Control Monuments)

- City of Naperville Land Survey Monuments
  - City of Naperville Survey Monument Locator Map

- West Chicago Survey Control Network
  - Horizontal Monument Location Map
  - Vertical Monument Location Map

CORS in Illinois

- National Geodetic Survey Cooperative CORS
  - NGS CORS Using Google Maps
  - NGS CORS Network Map

- DuPage County Cooperative CORS Network

- MoDCT: Missouri Department of Transportation
  - Illinois stations related to St. Louis area

Real Time Kinematic (RTK) Networks in Illinois

- IINRA Company SPSRS Site Information
  - Coverage throughout Illinois

- Seilier Instrument Company Midwest RTK Network
  - St. Louis and Indianapolis networks cover south-central Illinois

- Trimble VRS now – USA Illinois Coverage Map
  - Coverage for northern Illinois
How Can You Help?

• Request support of earmark
  – Congressman Timothy Johnson
    http://timjohnson.house.gov/
  – Congressman Aaron Schock
    http://schock.house.gov/
  – Senator Dick Durbin
    http://durbin.senate.gov/

• Ask you Congressmen to support earmark of those above
Questions?

Illinois Height Modernization Program

http://www.isgs.illinois.edu/nsdihome/webdocs/ilhmp

or

Google “Illinois Height Modernization”