Creating a Digital Surface Model of the Commonwealth of Virginia

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VGIN was established in 1997 in Virginia Code to:

"foster the creative utilization of geographic information and oversee the development of a catalog of GIS data available in the Commonwealth".

- **Standards & guidelines**
- **Basemap layers**
  - imagery, road centerlines & addressing
  - addressing, elevation, cadastral
- **Services** [gismaps.vita.virginia.gov/arcgis/rest/services](http://gismaps.vita.virginia.gov/arcgis/rest/services)
- **GIS Clearinghouse** [vgin.maps.arcgis.com](http://vgin.maps.arcgis.com)
- **GARDEN** collaboration with universities [garden.vgingis.com](http://garden.vgingis.com)
Definitions

- **Digital Elevation Model (DEM)** - ground surface topography
- **Digital Surface Model (DSM)** - elevation of all features including the ground, building, trees, etc.
Project Objectives

• Develop a digital surface model (DSM) of the entire area of the Commonwealth of Virginia for the best, most recent, and available data.

• Serve this DSM as a publicly available elevation web service, suitable for visualization and analysis.

• Utilize the DSM web service within the Virginia 3D Broadband Viewer.
Partners & Contributors

- VGIN
- Virginia Tech
  - Enterprise GIS
  - CGIT
- LiDAR Data Providers
  - USGS, NGA, FEMA, NRCS, DMME
  - Local governments
  - CIT State Broadband Initiative (Photo DSM)

www.vita.virginia.gov
Potential Application Examples from CGIT

- Wireless broadband coverage and RF propagation
- Assessment site suitability for vineyards
- Solar radiation assessment
- Transportation safety
Incoming solar radiation using a 5-m DSM produced using the SimActive Correlator 3D software with the 1-m VBMP stereopair imagery and metadata as input.

CGT 02/10/2011
sforza@vt.edu
Data Sources - LiDAR

10,851 square miles
3D Building Extraction and Urban Scale RF Model using Statewide DSM and DTM
Creating a Forest Canopy Height Model

DSM - DEM = CHM
2014 LiDAR Projects

6,475 square miles
## Project Area and Costs

<table>
<thead>
<tr>
<th>Year</th>
<th>Sq Miles</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>4,151</td>
<td>$1,152,683</td>
</tr>
<tr>
<td>2011</td>
<td>5,480</td>
<td>$1,773,083</td>
</tr>
<tr>
<td>2012</td>
<td>1,222</td>
<td>$ 559,300</td>
</tr>
<tr>
<td>2013</td>
<td>933</td>
<td>$ 379,000</td>
</tr>
<tr>
<td>2014</td>
<td>6,475</td>
<td>~ $2,000,000</td>
</tr>
</tbody>
</table>

**Total Area**: 18,261 Sq Miles

**Total Cost**: ~ $6,000,000

43% of Virginia
Methods - LiDAR

• Use first returns of the point cloud, filtering out “noise” points.
• First returns can be loaded into terrain datasets or rasterized into DEMs
• Can also use the point cloud files directly with
  – LAS datasets
  – Mosaic datasets of LAS files
  – Mosaic dataset of LAS datasets
Data Sources – Stereo Photography

Flight Year
- 2011
- 2013
**Methods – Stereo Pairs**

- **Autocorrelation**
  - Automated methods for locating features in two or more stereo pairs and computing their elevations

- Several commercial algorithms available

- We tested two
  - SimActive’s 3DCorrelator
  - Integraph’s SGM (Semi-global Matching)
Data Production and Management

- Sanborn processed the 2011 and 2013 imagery with SA to create DSM and delivered it as tiled LAS files
- VGIN performed QA/QC on Sanborn product
- VGIN gathered LiDAR data as LAS tiles
- VGIN has the VMBP digital terrain model of mass points and breaklines derived from traditional photogrammetry (update 2011/2013)
Mosaic Datasets

Catalog
Mosaicking Rules
Raster Properties

Produced “on the fly”
• VGIN transferred data to Virginia Tech’s Enterprise GIS Group
• VT Enterprise GIS will use ArcGIS Image Server Extension to serve
Remaining Steps

• Determine whether to use:
  – Breaklines
  – LAS datasets, terrains or LAS files to build mosaic datasets
  – LAS format or compressed zLAS format

• Determine service capabilities
  – DSM
  – DEM (ground surface) for LiDAR areas
  – DEM from VBMP DTM for non-LiDAR areas
  – LAS files downloads

• Create and publish services
Virginia GIS Clearinghouse
Virginia Geographic Information Network

Featured Content

- Download VBMP Road Centerline (RCL) Data
- VGIN RCL Submittals
- VGIN Address Point submittals
- VGIN Composite Geocoder

Virginia’s Statewide GIS Clearinghouse hosted by the Virginia Geographic Information Network (VGIN) and the Virginia Information Technologies Agency (VITA). The GIS Clearinghouse is a repository of geospatial data produced and used by state agencies in Virginia, localities in Virginia, our Federal partners, non-profits, and colleges and universities in Virginia. Questions? email John Scrivani

vgin.maps.arcgis.com
The GARDEN project is a joint initiative between the Virginia Geographic Information Network (VGIN) and leading universities in the Commonwealth of Virginia. Through GARDEN, participating universities serve as a "mirror" for VGIN’s datasets, providing a locally hosted, faster performing set of map layers to faculty, staff and students, while providing redundancy and geographic diversity of off-site storage locations to VGIN.

Virginia Tech’s GARDEN node is hosted at http://garden.gis.vt.edu.
Other GARDEN Sites

- William & Mary [garden.wm.edu](http://garden.wm.edu)
- In development
  - VCU
  - University of Richmond
  - Mary Washington
  - JMU
  - Radford
Questions ?