3D Atlas of Ann Arbor, 1st Edition

Editor, Sandra Lach Arlinghaus; contributors noted throughout the text.
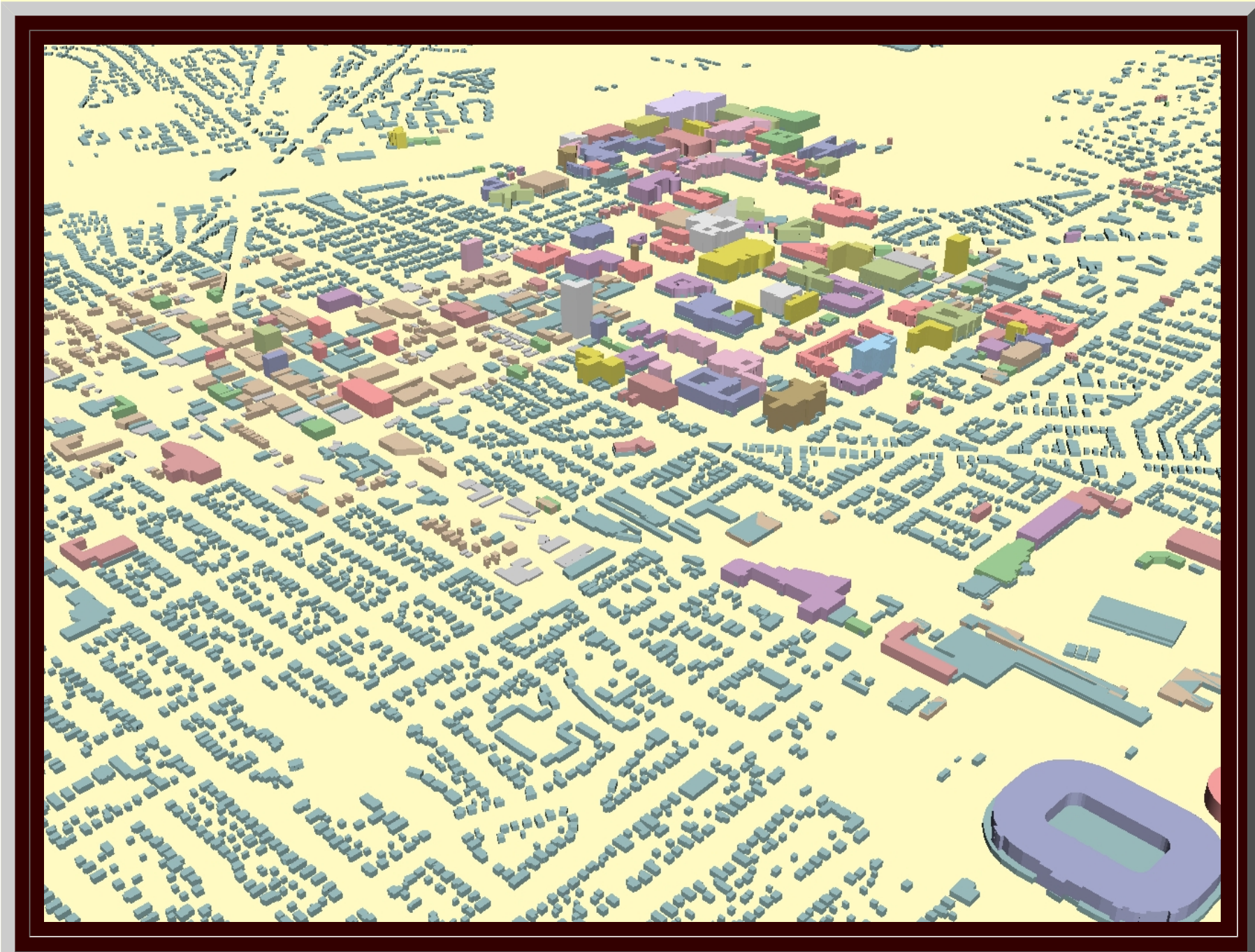**Copyright 2005, Institute of Mathematical Geography or by authors of documents.**

Image created by S. Arlinghaus based on input from Matt Naud, Paul Lippens, Wendy Rampson, Chandra Hurd Gochanour, and Donald T. Uchman.

Introduction

The 3D Atlas of Ann Arbor is an ongoing project begun five years ago. The early development centered on the creation of base maps/surfaces formed from buildings, terrain, streets, photographic textures, and so forth. There is abundant reference to this development in *Solstice: An Electronic Journal of Geography and Mathematics* (http://www.imagenet.org/). As the base surfaces emerged, so too did applications. Most of these centered on planning or on environmental and emergency management.   Numerous individual have contributed to the evolution of the Atlas that attempts to trace the intellectual path from GIS map to virtual reality models of Ann Arbor.

- The principal investigator: Sandra Lach Arlinghaus
- Students, teaching staff, and faculty in Engineering 477, Virtual Reality, College of Engineering, The University of Michigan
    - Students:
        - 2003: Taejung Kwon, Adrien Lazzaro, Paul Oppenheim, Aaron Rosenblum
        - 2004: Nikolai Nolan, Rasika Ramesh, Itzhak Shani
        - 2005: Alyssa J. Domzal, Ui Sang Hwang, Kris J. Walters
    - Teaching Staff, Graduate Student Instructors:
        - 2003: Thana Chirapiwat, Jamie Cope
        - 2004: Thana Chirapiwat, Jamie Cope, Bonnie Bao
        - 2005: Jamie Cope, Brian Walsh
    - Faculty, 2003, 2004, 2005: Professor Klaus-Peter Beier.
- Other faculty and external advisors:
    - 2003: Matthew Naud, Environmental Coordinator, City of Ann Arbor; John D. Nystuen, Prof. Emeritus, University of Michigan
    - 2004: Matthew Naud, Environmental Coordinator, City of Ann Arbor;
    - 2005: Matthew Naud, Environmental Coordinator, City of Ann Arbor; Paul Lippens, Intern, City of Ann Arbor; Braxton Blake, Composer and Conductor of Music, Edmond Nadler, Adjunct Prof. of Mathematics.
- Staff in the 3D Laboratory, Duderstadt Center, The University of

Michigan: Professor Klaus-Peter Beier, Director of the 3D Laboratory; Scott Hamm; Steffen Heise; Brett Lyons; Eric Maslowski; Lars Schumann

- City of Ann Arbor staff: Matthew Naud, Paul Lippens, Wendy Rampson, Chandra Hurd Gochanour, Alexis Marcarello, Merle Johnson, Jim Clare
- Members of the Downtown Residential Taskforce, Downtown Development Authority, City of Ann Arbor: Susan Pollay, Executive Director DDA; Fred J. Beal, Jean Carlberg, Robert Gillett, Karen Hart, Douglas Kelbaugh, William D. Kinley, Steve Thorp, Frances Todoro, Wendy   Woods. Substantial citizen input also from Brian Barrick, Ray Detter, and Peter Pollack.
- The University of Michigan: Donald T. Uchman, Coordinator of Space Graphics, Space Information and Planning, Plant Extension--AEC

There are thousands of files present to create a variety of images for use in application. Specifically,

    * there are extruded buildings, textures, streets, terrain, hydro, for the entire Downtown Development Authority
    * there are extruded buildings representing residences and businesses throughout the entire city (about 35,000 in all)
    * there are extruded buildings for the entire University of Michigan
    * there are modeled buildings for selected locations in the Downtown Development Authority.

New files from the City this past fall, for extruded structures for the entire city and for contours at a 1 foot contour interval, opened the door to consider preliminary environmental management applications involving floods. The software and the files that can be created is a moving target. Thus, it is important to have guidance from city officials and from interested members of the public to know where it is important to direct future effort.

The general strategy proceeds as follows.

- First, pilot projects are performed on small sets of data. This step is critical to ensure that no systematic error is introduced into the entire

study. There will always be isolated individual errors but the goal of multiple pilot projects is to remove systematic error and establish systematic procedure that will extend to larger studies.

- When pilot projects are complete, they are shown to a wide audience to get feedback. Feedback is then incorporated into the next round of pilot projects.
- Finally, the systematic strategy is extended to the entire region of interest.
- Then, feedback is sought, once again, to determine direction for application. The cosmetic features, many of which take time, that get developed are done so in response to feedback. Content guides development of substance; cosmetic features come later.

At this time, the technical strategy begins with an ESRI GIS program (of the client's choice) and ends with completed model. Some of the steps involved are listed below.

- Digitize all structures in Ann Arbor making sure not to include the building shadow or rooftops in the digitized files.
- Obtain heights for all structures in Ann Arbor.
  - Assessor's data for photos or heights
  - Field-check UM building heights of buildings with substantial basements.
- Obtain photographic textures of all structures in Ann Arbor: use a cherry-picker down the street centerline?
- Clean photographic images:
  - Stretch isosceles trapezoidal images to rectangles to fit building faces.
  - Remove foreground (use clone stamp tool)
- Apply photographic images to all structures.
- Obtain GPS coordinates of buildings if needed for Google Earth purposes.
- Model buildings with interesting rooflines; to date only 101 N. Main and City Hall have been modeled and they both need to be redone (as they are old pilots).
- Model streetscape: streets, lights, furniture, and so forth.
- Add links to show building interiors, voice links to identify buildings,

sounds, and so forth.
- File size consideration; layering of model with kiosks to link one layer to another—show different levels of detail at different scales.

The 3D lab will be very helpful in executing many of these tasks. Preliminary work has been done by the city with Google. Existing applications are archived in Solstice. Future applications might involve:

- More in planning
- More in emergency management
- Game or other possible fund-raising efforts based on the models
- Systematic strategy for modeling a flood (with Edmond Nadler)
- Training strategies

Suggestions and constructive commentary are welcome; they serve to drive the direction of the applications.

Chapter 1: Clickable Maps--Transition to 3D

Clickable maps offer the user the opportunity to look at the database associated with regions of the map. The creator of the map controls what data will be shown. Because there is some degree of user interaction, these maps have served as a transition to the fuller interaction of 3D models and virtual reality. There are numerous clickable maps in the appendices to this document. Similarly, animated maps (sample: **Tornado Siren Location: Ann Arbor, Michigan**) also offer a glimpse of extra dimensions...through time. They are covered fully on the website of *Solstice: An Electronic Journal of Geography and Mathematics* (**http://www.imagenet.org/**) and are not the focus of this document.

- 2005: **Building Footprints in Allen Creek Floodway and Floodplain**
- 2005: **Parcels in Allen Creek Floodway and Floodplain**
- 2003: **Ann Arbor Downtown Building Footprints and Height**
- 2003: **Ann Arbor Downtown Building Footprints and Height--variation**
- 2003: **Ann Arbor Downtown Building Footprints and Height--variation**
- 2003: **Ann Arbor Tornado Sirens and Database**
- 2003: **Washtenaw County: Interactive Clickable Map** (cell towers)
- 2003: **Sample Clickable Map for Environmental Management**
- 2002: **Cell Towers, Self-Reported**
- 2001: **Creekshed Website**
- 2001: **Parcels and Streets in Relation to Floodway and Floodplain, Allen Creek**

Chapter 2: 3D Maps, Models, and Applications

	PLANNING
2005	**News: Update on the 3D Atlas of Ann Arbor:** S. Arlinghaus **Archimedes in Ann Arbor:** S. Arlinghaus **Virtual Flood in the Allen Creek Floodplain and Floodway:** A. Domzal, U. S. Hwang, K. J. Walters Jr. for UM Eng. 477. **Kioskland: A Strategy for Linking Hierarchical Levels of Virtual Reality Maps:** S. Arlinghaus
2004	**Spatial Synthesis: 3D Atlas of Ann Arbor:** S. Arlinghaus **Downtown Residential Task Force--The View from the Top: Visualizing Downtown Ann Arbor in Three Dimensions:** S. Arlinghaus, F. J. Beal, and D. Kelbaugh --- CD set (3 CDs) given to City Council, DDA, and DRTF; Files given to Calthorpe **One Optimization of an Earlier Model of Virtual Downtown Ann Arbor:** K.-P. Beier **Virtual Map of Ann Arbor Downtown:** R. Ramesh, I. Shani, N. Nolan for UM Eng. 477.

2003	• **Ann Arbor, Michigan: Virtual Downtown Experiments:** S. Arlinghaus • **Ann Arbor, Michigan: Virtual Downtown Experiments, Part II:** S. Arlinghaus • **Ann Arbor, Michigan: Virtual Downtown Experiments, Part III:** T. Kwon, A. Lazzaro, P. Oppenheim, and A. Rosenblum for UM Eng. 477.
2002	• **Ordinance Revisions Committee, City Planning Commission: simple extrusion of parcels using building heights from Planning Department Staff.** S. Arlinghaus
2001	• **Ordinance Revisions Committee, City Planning Commission: simple extrusion of parcels according to Floor-Area-Ratio values supplied by Planning Department Staff.** S. Arlinghaus

ENVIRONMENTAL AND EMERGENCY MANAGEMENT

2005	- **Kioskland: A Strategy for Linking Hierarchical Levels of Virtual Reality Maps:** S. Arlinghaus - **Archimedes in Ann Arbor:** S. Arlinghaus - **Virtual Flood in the Allen Creek Floodplain and Floodway:** A. Domzal, U. S. Hwang, K. J. Walters Jr. for UM Eng. 477.
2004	- **Local groundwater issues, virtual reality: password needed. File** Arlinghaus, for M. Naud
2003	- **Lewis and Clark, 200 Years: A Visual Tribute to an Exploration. The Gates of the Rocky Mountains:** S. Arlinghaus, R. Haug, A. E. Larimore
2002	- **Animated 3D topographic maps: precursor to Virtual Reality. Mount Everest and Nepal.** S. Arlinghaus - **Local groundwater issues: password needed. File** M. Gamache for UP507
2001	- **Maps and Decisions: Allen's Creek Floodplain, Opportunity or Disaster? Simple animated map sequence.** S. Arlinghaus

Chapter 3: Presentations, Media, and Awards

- **Presentations:**
  - **2005:** **August 17**, invited by Matt Naud to present 3D material to a group of City Staff in the EOC.
  - **2004:**
    - **Downtown Residential Task Force, Public Hearing in Council Chambers, City Hall, April 27.**
    - **Downtown Residential Taskforce meetings. Link to article containing links to materials presented at all meetings: June 7, May 29, May 27, May 12, May 10, April 26, April 14, April 7, April 1, March 18, March 12, February 16, February 7, February 2.**
  - **2003:** November 11, 3D Lab, **GeoWall Display** of materials of the time for a group of about 15 people including a few City Council members and some City Staff as well as individuals from the University of Michigan.
- **Media:**
  - **2005:** *Ann Arbor News*: Sunday, November 27. "**Whose Vision Will Prevail in Ann Arbor?**" Judy McGovern, Managing Editor, Features. First page of "Connection," Section E.
  - **2004:** *Ann Arbor News*: Wednesday, April 28. "**High Rise City Is Envisioned,**" Tom Gantert, Front Page.
  - **2003:** *Ann Arbor News*: Saturday, July 5. "**A Pair of Emergency Sirens Added to Ann Arbor System**," Tracy Davis, Front Page.
- **Awards:**
  - **2004:** **President's Volunteer Service Award.**
  - **2003:**
    - **July 10:** *Ann Arbor News*, "Cheers and Jeers"
    - **July 15:** **Letter** from Member of Congress, U.S. House of Representatives, John D. Dingell
  - **1999:** **Ann Arbor Map of Neighborhoods**

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Chapter 4: Appendices

- **Custom Map Projects: Selected Student Work, 1999-2003, The University of Michigan. Arranged by topic. To see material arranged by course and chronologically, and the full display of all student sites, see website at http://www-personal.umich.edu/~sarhaus/ and scroll down to the link on "courses" (which also includes lecture material).**

  - **Ann Arbor, only, projects**
    - **Huron Hills Golf Course. Clickable map set and animation given to Parks Department along with expert commentary from a member of UM golf team and winner of City of Ann Arbor Men's Championship: Andrew Walton, 2003, for UP402.**
    - **Parks and Schools Directory. Clickable map set given to Parks Department: Zeb Acuff, 2003, for UP507.**
    - **Bike Parking. Clickable Map served as a base for future work: Simon Van Leeuwen, 2003, for UP 507.**
    - **Urbanimals. Poster presented to City of Ann Arbor Planning Commission: Emile Lauzzana, 2003.**
    - **Ann Arbor Bike Accident Map. Accumulation of information from various sources to advance the record: Hyeyun Lee, 2002 for UP 507.**
    - **Clear Waters and Green Lawns. Clickable maps: Adam Pettinger, Brad Fuzak, Kathryn King, and Alan Striegle, 2002, for UP 402.**
    - **Landscape Change in a Neighborhood of Ann Arbor. Clickable maps: Katya Podsiadlo, 1999, for NRE530.**
    - **Ann Arbor Map of Neighborhoods: award-winning project created for the City of Ann Arbor Planning Department and variations of it still appear on the City website. Clickable map set: Rosalyn Scaff, 1998, for NRE530. Updated later by Wayne Buente, another student in a different course of SA, when Wayne was an intern in Planning.**

- UM Buildings, Energy Consumption. Clickable map set served as base for future work: Thana Chirapiwat, 1998, for NRE530.
- UM Residence Halls Map. Clickable map set given to UM Housing: Danielle K. Dipert, 1998, for NRE530.
- Natural Area Preservation. Focus on burn program created for Parks Department: Amie Ottinger, 1997, for NRE530.

- Historic Districts:
  - Historic Districts of Ann Arbor. Clickable map set: Ron Keolian, Rachel Hornstein, and Vanessa Reisin, 2002, for UP402.
  - Historic Districts of Detroit. Clickable map set: Paula Kremidas, 2001, for UP507.

- Ann Arbor and More:
  - Improving Water Quality in the Rouge River Basin. Animated maps. Moira Zellner, 2001, for UP507.
  - Rivers and Toxic Waste Sites. Animated maps and clickable maps. Sabrina Corte, 2001, for UP402.
  - Science and Society. Stacked agricultural maps by crop. Angie Van Erp, 2001, for UP402.
  - Imperviousness and Watersheds. Mark Brush, 1999, for NRE530.
  - Land Use Change in Washtenaw County. Stacey Schulte, 1999, for NRE530.
  - Fiscal Impacts of Sprawl. Animated maps. Hui-Chun Huang, 1999, for NRE530.
  - Projected Buildout of Pittsfield Township. Da-Mi Maeng, 1998, for NRE530.
  - Michigan Conservation Districts. Joe Holtrop, 1998, for NRE530. Journal/metadata.
  - Washtenaw Heritage Connection. Clickable map: Kate Druecke, 1997, for NRE530.

- **Bromley Homeowners' Association. <u>Neighborhood Information System</u>, created in 1990 by the first author (and maintained by her) and supplemented by both authors in 2000: Sandra L. Arlinghaus and Lloyd R. Phillips (for a Directed Study in NRE)**

- **NSF <u>Grant Proposal</u> and <u>Budget</u> to develop a 3D Atlas of Ann Arbor (not granted).**

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