

# **History of GIS**

In the Computer Automation Era  
Part I – 1940 to 1970

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# Background

- Why?
  - Random conversation in Matt McGrath's office in April 2007 (we both knew *very little* about this topic)
- Focus
  - Timeline style approach
  - Nothing truly historical (e.g., before computers)
- Caveats
  - We are not historians, merely curious ESRI development staff
  - **Intended to be low-key and fun – not scholarly**
  - Determining what is historical is quite hard ...

# Overview

- Timeline of GIS development
- Key academic developments
- Significant contributors
- Commercial technologies
- Cold War's influence
- Impact of computer technology
- ESRI's role

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- Impact of computer technology
- ESRI's role
- ***Lots of amazing trivia***

# Message to Our External Reviewers

*Your chance to influence history! Shape how young minds perceive the past! Cement your place (and your friends) in the historical record! Expunge your enemies and the wannabees!*

# 1941

- The **Atanasoff–Berry Computer (ABC)** was developed at Iowa State by John Atanasoff and Clifford Berry
  - The first electronic digital computing device
  - Conceived in 1937, it was capable of solving up to 29 simultaneous linear equations
  - Pioneered important elements of modern computing, including binary arithmetic and electronic switching

# 1945

- Secret U.S. Army team led by Geodesist Floyd Hough (**HOUGHTTEAM**) captures vast quantities of German photogrammetric equipment, geodetic, and cartographic data
  - Geodetic archives of the German Army hidden in secret warehouse in Saalfeld
  - Data included first-order geodetic surveys of large parts of Soviet Union and Eastern Europe
  - 90 tons of captured materials
  - Secured a nucleus of German geodesists
  - Much remained secret till 1990s

# 1947

- **Mapping and Charting Research Laboratory**  
established at Ohio State
  - Funded by U.S. Air Force
  - Assembled the world's largest and most productive corps of geodetic scientists
  - Particularly strong in gravimetry and photogrammetry
  - Trained large numbers of analysts and scientists

# 1949

- **First practical stored program computer** developed at the Univ. of Manchester – **EDSAC**
  - Idea originated with Presper Eckert, John Mauchly, and John von Neumann in 1946

# 1949

- **Norman Ramsey** develops the **Atomic Clock**
  - Based upon **Isidor Rabi's** (Columbia) research between 1938-1940 on measuring the natural resonate frequencies of atoms
  - Atoms pass twice through an oscillating magnetic field – the oscillating field becomes a metronome to generate time pulses

# 1950

- Development began on the USAF's **SAGE** (*Semi Automatic Ground Environment*) air defense system
  - The first **graphic system**
  - Developed at MIT's Lincoln Laboratory
  - Used CRT displays to show computer-processed radar data and other information
  - IBM built the AN/FSQ-7
    - 250 ton computer

# 1952

- **Arthur Robinson** publishes the revolutionary ***The Look of Maps***
  - Based upon his doctoral research at Ohio State
  - Urged cartographers to consider the function of a map as an integral part of the design process
  - Set the dominant cartographic research agenda
  - **The origin of modern university cartography**
  - Was Chief of Map Division for the OSS during WWII
  - Later developed the Robinson Projection

# 1952

- International Council of Scientific Unions (ICSU) proposes the **International Geophysical Year (IGY)**
  - Comprehensive series of global geophysical activities to span July 1957-December 1958
    - Auroras, cosmic rays, geomagnetism, gravity, ionospheric physics, precision mapping, meteorology, oceanography, seismology, and solar activity
  - Timed to coincide with the high point of the eleven-year cycle of sunspot activity

# 1955

- **DMATS (Detroit Metropolitan Area Traffic Study)** completed
  - **First assemblage of all the elements of an urban transportation study**
  - Led by **J. Douglas Carroll Jr.**
  - Trip generation rates by land use category
  - Future trips were estimated from a land use forecast
  - Produced maps of traffic flow and volume
  - Much of the work was done by hand with the aid of tabulating machines for some of the calculations
  - Cost/benefit analysis of expressway network

# 1955

- **CATS (Chicago Area Transportation Study)** initiated
  - Set the standard for urban transportation studies
  - Lessons learned in Detroit were applied in Chicago with greater sophistication by **J. Douglas Carroll Jr.**
  - Transportation networks were developed to serve travel generated by projected land-use patterns
  - Networks evaluated based on economic efficiency
  - Simple land-use forecasting procedure was employed to forecast land-use and activity patterns
  - **Made major advances in the use of the computer in travel forecasting**

# 1956

- **GENETRIX** initiated by USAF
  - Camera carrying high altitude balloons launched from Western Europe, recovered in mid-air over the Pacific
  - 219 balloons launched, 40 recovered
  - 28 day program before cancellation
  - Very significant tool to improve maps of the Soviet Union and China (8% coverage, ~13,000 images)
  - Derivative of camera later used on first reconnaissance satellites

# 1957

- **International Geophysical Year (IGY)**
  - 67 nations, 60,000+ scientists worked to understand the earth as a planet
  - Soviet Union launched Sputnik 1
  - United States launched Explorer 1
  - Van Allen radiation belts discovered
  - Mid-ocean ridges discovered (plate tectonics)
  - Antarctic ice mass estimated

# 1957

- 4 ОКТЯБРЯ, **Спутник** (Sputnik 1) launched by the Союз Советских Социалистических Республик (СССР) using their R-7 rocket
  - **First satellite to achieve orbit**
  - Established precedent of open skies in space
  - Mounting of cameras on orbiting spacecraft became possible

# 1957

- **Gilbert Hobrough** develops the first successful **Stereo Image Correlator** – a key event in the development of digital photogrammetry
- Hobrough had 47 patents in many areas:
  - Phonograph turntable and tonearm
  - High-fidelity speaker design
  - Radar and barometric altimetry
  - 3D vision
  - Laser interferometry

# Photogrammetry

- Swiss companies **Wild Heerbrugg** and **Kern Aarau** led much of the development
  - Basic theory developed in Germany in the 19th and early 20th century
  - Main driver: the need for military maps for reconnaissance in a topographically difficult country such as Switzerland, as was required during the period between WWI and WWII

# 1958

- **Univ. of Washington Department of Geography**
  - center of intense advanced research on scientific quantitative geography (**William Garrison** and his students) – the ‘new geography’
    - Developed now classical techniques in spatial analysis, statistical methods, measure of spatial distributions, techniques of spatial comparison, 3D and n-dimensional analysis, network analysis, and geographic modeling techniques
    - Walter Christaller – Central Place Theory (1933)

# Univ. of Washington

- Students of **William Garrison**:
  - **Brian Berry** – urban and regional research sparked geography's social-scientific revolution - the most-cited geographer for more than 25 years; member NAS
  - **William Bunge** – theoretical geography (dependence of geographical theory on geometry and topological mathematics)
  - **John Nystuen** – fundamental spatial concepts (distance, orientation, connectivity)
  - **Waldo Tobler** – algorithms for projection, cartography
  - Others: **Duane Marble, Richard Morrill, Michael Dacey**

# Time Travel back to 1937

- **John K. Wright** publishes article demonstrating how the **Lorenz Curve** can be applied to geographic space
  - **First significant example of quantitative geography**
  - Lorenz Curve takes social variables (e.g., income, population, voting patterns, crime, or land area) and compares them with one another to find the relative evenness of distribution in space

# 1958

- **TERCOM** (Terrain Contour Matching) development starts at the USAF's Wright-Patterson AFB
  - Missile guidance system
  - Basic premise is any geographic location on Earth is uniquely identified by the vertical contours of the surrounding terrain
  - Reference contour data stored in guidance system computer
  - **First digital terrain model**
  - First used with **SLAM (Project Pluto)** – nuclear ramjet powered supersonic low altitude cruise missile

# 1958

- **Jack Kilby** (Texas Instruments) and **Robert Noyce** (Fairchild) co-invent the **first integrated circuit**
  - Kilby's approach was the solid circuit with flying leads (not monolithic, but the first step)
  - Noyce's approach was the planar process (all interconnects on the surface)
  - Huge revolution, allowed drastic reduction on size and component count for computers

# 1959

- First **CORONA** satellite launch (military reconnaissance) as part of Discoverer 4
  - Carried ~10km of 70mm panchromatic film
  - ~10m resolution (improved to 2m by 1972)
  - Returned film canisters to Earth in capsules, which were recovered in mid-air by C-119
  - Images used for base maps due to once a month capsule returns
  - 144 Corona satellites
  - USAF/CIA program - 1959-1972
  - Secret until 1992

# 1959

- **MIMO (Map In-Map Out)**
  - **Waldo Tobler** outlines a model for applying the computer to cartography
  - The principles of the MIMO system were the origins for geocoding, data capture, data analysis and display
  - The MIMO system contained all of the standard elements found in GIS software
- **International Cartography Association (ICA)**  
founded in Bern
  - **Eduard Imhof** (Swiss Federal Institute of Technology, Zürich - ETH) was the first president

# 1960

- Led by **Robert Miller**, the US Forest Service creates new **forest inventory system** using punch cards on the IBM 650 electronic tabulators
  - **Considered major breakthrough in compiling data summaries – a true paradigm shift in processing field data**
  - IBM 1620 moved USFS beyond tabulators; programmable in FORTRAN
  - Began hiring people to program (compile, edit, and analyze the data)

# 1960

- Digital Equipment Corp. introduces their first product – the **PDP-1 minicomputer**
  - \$120,000 (\$802,000 today)
  - First computer to run a videogame (**Slug Russell**, MIT, **Spacewar**)
  - Two-player game involving warring spaceships firing photon torpedoes
  - By the mid-sixties, Spacewar could be found on nearly every research computer in the US
  - *Wickedly addictive game*
  - Famous for being the most important computer in the creation of **hacker culture**

# 1960

- **TRANSIT** (also known as **NAVSAT**), the **first satellite navigation system**, used by the US Navy, was successfully tested
  - Used a constellation of five satellites
  - It could provide a navigational fix (200 meter accuracy) approximately once per hour
  - Led by **F.T. McClure** (Johns Hopkins APL)
  - Doppler shift, encoded signal
  - Used for ballistic missile submarine positioning

# 1960

- U.S. Military develops the first **World Geodetic System (WGS60)**
  - Mass centered datum
  - Critical for ICBM targeting and deployment of reconnaissance satellites
  - Large geodetic systems (e.g., ED50, NAD, and TD) unable to provide worldwide coverage
  - Development considered by some as one of the most important American intellectual achievements of the Cold War era

# 1960

- **Kriging** developed by French mathematician **Georges Matheron**
  - Minimum mean-squared error method of spatial prediction
  - Named after **D.G. Krige** (South African mining engineer) who developed empirical methods for estimating ore distributions in 1951
  - Matheron regarded by many as the father of **geostatistics**
  - Professor at the Paris School of Mines in Fontainebleau

# 1961

- **RACOMS** (Rapid Combat Mapping System) begins development by US Military
  - Produce four 1:50,000 topographic quads of military mapping intermediate-accuracy class
  - New photography to map production within 48 hours
  - Geodetically correct map base needed for rapid turnarounds

# 1961

- First **SAMOS** satellite achieved orbit
  - Reconnaissance satellite was first to develop film in space, scan the negative, and **transmit the image back to Earth**
  - Cancelled in favor of CORONA due to lesser quality imagery
    - 30m resolution, frame readout
    - Later versions used film return
  - Later used as the NASA Apollo Lunar Orbiter mapping camera

# Military Mapping

- Impossible to accurately estimate money spent on the full cartographic enterprise
  - Black budgets for CORONA and other sensors never disclosed
  - Some assume classified mapping applications based on top secret sensors were more expensive than publicly acknowledged systems
  - Example: RC-135A/USQ-28 aerial mapping system of 1960s
    - \$120M (\$750M today)

# Military Mapping

- Military laid many foundations; contracts provided money to several companies that play leading roles in GIS today; some prominent researchers were involved in both the military and academic worlds (e.g., Waldo Tobler)
- Others contend that the military provided little that the commercial world found useful (other than GPS)
- Many significant military programs remained classified until the past ten years
  - E.g., CORONA

# 1962

- **Rachel Carson** publishes ***Silent Spring***
  - Some of the first public evidence of how pesticides (e.g., DDT), used without proper control or knowledge, were poisoning the environment
  - Title evoked a spring season in which no bird songs could be heard because they had all died from pesticides
  - Widely credited with launching the environmental movement in the West

# 1962

- Max Waters and Franklyn Perring (Biological Records Centre - BRC) author the ***Atlas of British Flora***
  - BRC held the atlas data on record cards and punched cards
  - ~1700 species
  - Used mechanical equipment for data-processing, using 40-column punched cards
  - **One of the earliest machine readable geographical databases**

# 1962

- **Apollo Guidance Computer** becomes first computer to be implemented with **integrated circuits**
  - Designed at the MIT Instrumentation Lab (now the Charles Stark Draper Lab) by a team led by **Eldon Hall**
  - Directly influenced by the Poseidon and Polaris missile guidance systems
  - Integrated circuits were considered a huge (and expensive) gamble at this time
    - In 1960, ICs were ~\$1000 each from Texas Instruments

# 1963

- Development of **CGIS (Canada Geographic Information System)** starts, led by **Roger Tomlinson**
  - System was needed to analyze Canada's national land inventory and pioneered many aspects of GIS
  - A very significant milestone
  - First widespread use of “geographic information system” terminology (1966)
  - Over 40 people actively involved in the development of CGIS between 1960-1969
  - Built by IBM under contract to the Canada Land Inventory

# CGIS

- Advances pioneered by **CGIS**
  - First cartographic scanner (48")
  - Raster to topological vector conversion (Don Lever)
  - Integration of scanning, digitizing, and keypunch data encoding
  - (Guy) Morton coding (indexing) and compression
  - Topological coding of boundaries (first known use of the link/node concept); attaching polygon attributes to points (spaghetti and meatballs)
  - Automated edge matching across tiles/sheets
  - Spatial coordinate systems
  - Command language for data overlay

# 1963

- **Edgar Horwood** (Civil Eng. And Urban Planning, Univ. of Washington) conducts training workshop at Northwestern on his **Card Mapping Program** and **Tape Mapping Program**
  - Programs displayed thematic data associated with statistical administrative zones
  - Inspired **Howard Fisher** to create SYMAP
- Horwood led the creation of **URISA** and served as first president
- Prior to 1960, offered **first academic course** utilizing computer processing of geographic information (according to Nick Chrisman)

# Horwood's Short Laws

- 1. Good data is the data you already have**
- 2. Bad data drives out good**
- 3. The data you have for the present crisis was collected to relate to the previous one**
4. The respectability of existing data grows with elapsed time and distance from the data source to the investigator
5. Data can be moved from one office to another but it cannot be created or destroyed

# Horwood's Short Laws

- 6. If you have the right data you have the wrong problem and vice versa**
7. The important thing is not what you do but how you measure it
- 8. In complex systems there is no relationship between information gathered and the decision made**
9. Acquisition from knowledge is an exception
- 10. Knowledge flows at half the rate at which academic courses proliferate**

# 1963

- The **Mouse** was invented by **Doug Engelbart** while working at the Stanford Research Institute (SRI)
  - It was first widely used 20 years later in the Apple Lisa

# 1963

- **SKETCHPAD** developed at MIT by **Ivan Sutherland**
  - Allowed the designer to interact with his computer graphically: the 3D design could be fed into the computer by drawing on a CRT with a light pen – visual access to data and 3D were **radical ideas**
  - This changed how people interacted with computers

# 1964

- **The Harvard Lab for Computer Graphics and Spatial Analysis** was established by **Howard Fisher**
  - Large grant from the Ford Foundation
  - Very significant research center, created pioneering software for spatial data handling
  - Many key individuals in industry participated:
    - Jack Dangermond, Scott Morehouse, Hugh Keegan, and Duane Niemeyer (ESRI)
    - David Sinton (Intergraph)
    - Lawrie Jordan and Bruce Rado (ERDAS)

# Harvard Lab

- Many key academics also participated:
  - Nick Chrisman
  - Geoff Dutton
  - Randolph Franklin
  - Tom Poiker
  - Carl Steinitz
  - William Warntz

# Harvard Packages

- **SYMAP** – general purpose mapping, output on line printer, simple to use, enormous interest
- **CALFORM** – SYMAP on a pen plotter, table of point locations
- **SYMVU** – 3D perspective views of SYMAP output, first new form of spatial display
- **GRID** – raster cells, multiple layers
- **POLYVRT** – topology, format conversion
- **ODYSSEY** – comprehensive vector analysis, first robust and efficient polygon overlay (including sliver removal)

# 1964

- IBM introduced the world's first true multipurpose computer, the **IBM System 360**
  - Prior machines were either scientific or commercial
  - **Highly** configurable
  - 8-bit bytes
  - 32-bit words
  - Byte-addressable
  - Microcoded CPU
  - EBCDIC

# 1964

- The **free-cursor tablet digitizer** invented by Ray Boyle and David Bickmore
  - Part of the CGIS project
  - Boyle considered a pioneer of modern digital cartography
  - Grid of wires under the surface that encoded horizontal and vertical coordinates in a small magnetic signal; the stylus received the magnetic signal, which was decoded back as coordinate information

# 1964

- **Brian Berry** (University of Chicago) proposes the **Geographic Matrix**
  - All geographic information can be put in a matrix of infinite dimensions
    - Columns are places
    - Rows are characteristics
    - Time is the third dimension
  - Regional analysis involves a detailed study of a column of the matrix
  - Thematic analysis involves the study of a row of the matrix

# 1965

- **Gordon Moore** (founder, Fairchild Semiconductor – later founded Intel) observes:
  - The number of transistors that can be inexpensively placed on an integrated circuit is increasing exponentially, doubling approximately every two years.*
- Termed **Moore's Law** by Carver Mead (Cal Tech) in 1970
- Describes the driving force of technological and social change in the late 20th and early 21st centuries

# 1965

- **Fuzzy Set Theory** was introduced by **Lotfi Zadeh** (Berkeley)
  - Introduced the concept of a class with unsharp boundaries
  - Proposed the making of the membership function operate over the range of real numbers  $[0,1]$
  - Demonstrated that fuzzy logic was a generalization of classical logic
  - Significant impact upon the analysis and modeling of geographic data

# 1966

- **SYMAP (SYnagraphic MAPping System):** a pioneering automated computer mapping application
  - Begun by **Howard Fisher** at the Northwestern Technology Institute and completed in the Harvard Lab

# SYMAP

- Capable of producing isoline, choropleth, and proximal (Thiessen polygon) maps
- Used line printers as mapping devices
- Easy to use by 1965 standards
- Over 500 institutions acquired SYMAP
  - Also believed to be commonly pirated
- First widely distributed package for handling geographical data

# 1966

- Development of **LARSYS** begun at the Purdue Laboratory for Applications of Remote Sensing (LARS)
  - First system capable of processing **multispectral image data**
  - Became a research lab standard
  - Later incorporated into JPL's VICAR system, used for manipulating image data that had developed out of early interplanetary space probes

# 1967

- U.S. Bureau of Census **DIME (Dual Independent Map Encoding)** topological data format was developed
  - Address coding guide – match streets against addresses
  - For the New Haven Census Use Study
  - Explicit topology for street segments with left/right address ranges, to/from nodes, etc.
  - Topology used for data quality/integrity
  - Eventually morphed into TIGER in the 1980s

# 1967

- **Donald Cooke** and **William Maxfield** (Bureau of the Census) publish first paper in an academic journal on **topological data structures**
  - *The Development of a Geographic Base File and Its Use for Mapping*, In Papers from the 5<sup>th</sup> Annual URISA Conference
- NASA initiated the **Earth Resource Technology Satellite (ERTS)** program - later renamed **LANDSAT**
- **AUTOMAP (Automatic Mapping System)** became operational
  - Developed by the US Central Intelligence Agency
  - It could produce coastlines and any form of line or point data
  - A map compilation program at the world level

# 1967

- The **Experimental Cartography Unit (ECU)** was established at the Royal College of Art in London by **David Bickmore**
  - Focus on using computers to streamline the making of hardcopy maps
  - Developed the Oxford System of Automated Cartography with **Ray Boyle**
  - Led to development of first **free-cursor digitizer**
  - Collaborations with Ordnance Survey helped OS's push to digital

# 1968

- **Transportation Information System**
  - Developed by **Robert Tweedie** of the N.Y. State Department of Transportation
  - Based on grid manipulation
  - It incorporated geocoded land use and travel characteristics
  - The output of this system was line printer dot maps

# 1968

- Apollo 8 takes **first images of Earth from deep space** orbiting the Moon during Christmas
- **National Geographic Society** publishes their map of the moon
  - Indexes hundreds of lunar features
  - Landing spots for lunar missions
  - Descriptions of the moon's phases
  - Depicts the moon's revolution in relation to the Earth and Sun
  - How the moon affects tides on Earth

# 1968

- **David Sinton** and the Harvard Lab develop **GRID (Graphic Display of Rectangular Grid Information)**
  - Early raster-based modeling system
  - Allowed multiple overlays of data
- Public Service of Colorado's **CINS (Common Identification Number System)** project begins
  - **First AM/FM system**
  - Used state plane coordinate system
  - Central land and facilities database

# 1968

- **Whole Earth Catalog** first published
  - Purpose was to provide education and "access to tools" in order that the reader could *"find his own inspiration, shape his own environment, and share his adventure with whoever is interested."*
  - **Steve Jobs** considered the *Catalog* a conceptual forerunner of a Web search engine, *"sort of like Google in paperback form ... it was idealistic, and overflowing with neat tools and great notions"*
  - **Scott Morehouse** said *"I was influenced by the Whole Earth Catalog. That's how I actually got into GIS. It was the whole-system approach and systems thinking that the Whole Earth Catalog epitomized."*

1969

- **Environmental Systems Research Institute (ESRI)** was founded by Jack and Laura Dangermond

## ESRI – Early Years (thru 1980)

- Consultants for landuse analysis projects
- NOT a software company
- Software created as one-off solutions
  - GRID (1969), GRIDTOPO
  - PIOS (1970)
- Training part of the package
- Support by phone anyone who answered
- Newsletters to users (1979)

# 1969

- **Intergraph Corporation** was founded by **Jim Meadlock** (Harvard Lab) and four others from the Saturn V rocket program in Huntsville
  - Originally called M&S Computing Inc.

# 1969

- **Laser-Scan Laboratories** founded in the United Kingdom by Otto Frisch, Graham Street, and John Rushbrooke from the High Energy Physics group at the Cavendish Laboratories, Cambridge
  - Initial focus on Sweepnik film scanner hardware, then on large screen displays and accurate laser plotters

# 1969

- **Ian McHarg's** landmark book ***Design With Nature*** published
  - First book to detail many of the concepts of GIS analysis
  - Helped pioneer the development of map overlay techniques
    - Overlaid transparency maps (reflecting social values placed on different environmental factors); the composite showed where development more suitable given values placed on each factor

# 1969

- Other significant examples of map overlay *predating **Design With Nature***:
  - 1930s: US Government as part of New Deal planning (e.g., city maps with layers representing high concentrations of decrepit buildings, “red-lining”)
  - 1940s: German Military (e.g., 20+ layers showing vegetation, soil, and road surfaces), *General Plan of the East*, etc.
- ***Design With Nature*** is still considered by some as having a greater influence on development and application of GIS than any other single event

# Ian McHarg

- Significant impact upon landscape architecture, land use and environmental planning, as well as GIS
- Also on a **postage stamp**

# 1969

- **ARPA** (Advanced Research Projects Agency) begins development of **ARPANET** to allow resource sharing among subcontractors
  - Wide-area packet-switching network
  - Eventually evolved into the Internet

# 1970

- **First Law of Geography** by Waldo Tobler
  - *Everything is related to everything else, but near things are more related than distant things*
- **First GIS conference** sponsored by the International Geographical Union (IGU)
  - Representatives of all known GIS systems invited
  - 40 participants

# 1970

- **NEPA (National Environmental Policy Act of 1969)**
  - All federal agencies and funded programs must consider environmental impact of major or significant actions
  - Recognized as most significant motivating factor behind use of GIS by many federal agencies
- **Edgar Codd** proposes the **relational data model**

# 1970

- **Torsten Hägerstrand** (Lund University, Sweden) publishes ***What about People in Regional Science?***, the first treatment of a **space-time path**, used in monitoring human activity
  - A space-time path illustrates how a person navigates their way through the spatial-temporal environment
  - A powerful and simple concept

# 1970

- **Ken Thompson, Dennis Ritchie, and Douglas McIlroy** at Bell Labs, develop **UNIX** on a Digital PDP-7 in assembler
  - Development spurred by Thompson's **Space Travel** game that he wrote for the GE-645 mainframe (the game was too slow and cost \$75 per run)

# References – Personal Communications

- Nick Chrisman (Univ. of Laval)
- John Cloud (USGS)
- Teresa Dolan (ESRI)
- Geoff Dutton (Spatial Effects)
- Sara Fabrikant (Univ. of Zurich)
- Paul Hardy (ESRI-UK)
- Harlan Heimgartner (ESRI)
- Hugh Keegan (ESRI)
- Mike Kevany (PlanGraphics)
- Robert Laurini (INSA Lyon)
- David Maguire (ESRI)
- Scott Morehouse (ESRI)
- Bill Moreland (ESRI)
- Peter Woodsford (1Spatial)
- Pusheng Zhang (Microsoft)
- John (docent, USS Midway)