

# **NACIS XIII**

## ***Cartography in a Changing World***



**North American Cartographic  
Information Society**

**Thirteenth Annual Meeting**

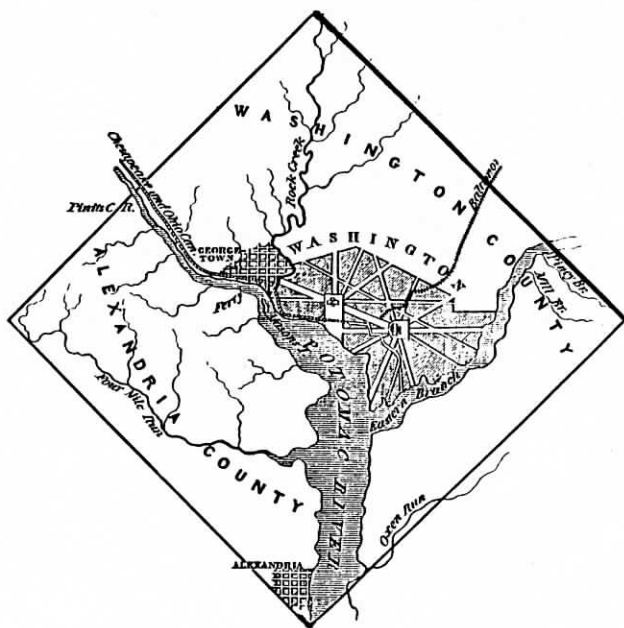
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**October 20-23, 1993  
Quality Hotel  
Silver Spring, Maryland**

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Welcome to Silver Spring and the Washington, D. C. area, home base for the thirteenth annual meeting of the North American Cartographic Information Society (NACIS). It is the hope of the few that the cartographic needs of the many will be fulfilled at our conference this year. The purpose of NACIS XIII is to give a variety of sessions and activities to enhance your cartographic knowledge and to make your visit here a pleasant one.

The wide spectrum of papers, workshops, field trips, tours and speakers listed in the program reflect the theme of this year's conference "*Cartography in a Changing World*." We have tried to put together a program that appeals to cartographers, map librarians, geographers and academia and I believe we have; all of you, of course, will have the final say.

I am very appreciative and thankful to Susan Nelson, Howard Danley, Donna Schenström, Sona Andrews, Allen Feldman, Ron Grim and Juan Valdez for their difficult task of local arrangements, poster sessions, exhibits, field trips, workshops and tours. I am also grateful for much advice and counsel from people like Ron Bolton, Jeff Patton, Jack Dodd and Chris Baruth.

I encourage all of you to take an active part in the conference as well as the Society.

Learn a lot and have fun here in the Nation's capitol.

*Chuck Harrington*  
Vice President and  
Program Chair

## 1993 NACIS OFFICERS

|                            |  |
|----------------------------|--|
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|                            | <b>John Sutherland</b><br>University of Georgia  |
|                            | <b>Juan Valdez</b><br>National Geographic Society                                      |

## **Wednesday, October 20**

**2:00 - 7:00 pm**      **Registration - Chesapeake Foyer**  
**Exhibits/Poster Setup - Potomac Room**

**2:00 pm**              **NACIS Board Meeting - Quorum Room**

**7:30 pm**              **Opening Session - Chesapeake Room**  
**Keynote Speaker**  
Richard Furno, Washington Post

**9:00 - 11:00 pm**      **Exhibits, Poster Session, Reception**  
**& Cash Bar - Potomac Room**

**Organizers:** Donna G. Schenström, Univ. of Wisconsin-Milwaukee and Howard Danley, NOAA/C&GS

- Zahdreh Allen-Lafayette, New Jersey Geological Survey
- James Anderson, Jr., Florida State University
- Hubertus L. Bloemer and Andrews Rawnsley  
Ohio University
- Jan Coyne, University of Florida
- Mark Eboch, University of Toledo
- Will Fontanez, University of Tennessee
- Jeff McMichael, Georgia State University
- Gyula Pauer, University of Kentucky
- Donna Genzmer Schenstrom,  
University of Wisconsin-Milwaukee
- Maryann C. Scott, New Jersey Geological Survey
- Joseph W. Stoll, University of Akron
- Alex Tait, Equator Graphics
- Richard Vaupel, Northern Illinois University
- Ellen White, Michigan State University
- Mark Williams and John Parsons, Eureka Cartography

## Thursday, October 21

**8:00 am - 7:00 pm    Registration - Chesapeake Foyer**

**8:30 am - Noon       Exhibits/Posters Open - Potomac Room**

**8:30 - 10:00 am    *SESSION A: Animation in Cartography***  
Chesapeake Room

**Orientation Biases & Animated Maps**

Robert Lloyd and Rex Cammack  
University of South Carolina

**Conceptualization & Planning of Map Animations**

Daniel Etter, GeoSystems and Martin von Wyss, Penn State University

**Map Animation: The Dynamic Variables Extended**

Alan M. MacEachren, Penn State University

**8:30 - 10:00 am    *SESSION B: Cartographic Serendipity***  
Assembly Room

**Differences in Epistemological Beliefs and Map Interpretation**

Julio C. Rivera, Univ. of Wisconsin-Milwaukee

**Categorizing the Cartographic Representation of Time**

Irina Vasiliev, SUNY College at Geneseo

**Education in a Multi-Disciplinary Environment**

Kit Fuller, U.S. Geological Survey

**10:00 - 10:30 am    Break**

|                        |  |
|------------------------|--|
| <b>10:30 - Noon</b>    | <p><b><i>SESSION C: Cartographic Data and Map Librarians</i></b> - Chesapeake Room</p> <p><b>Evaluation of Programs for the Storage &amp; Retrieval of Cartographic Data.</b><br/>Lisa A. Recupero, University of Missouri, Rolla</p> <p><b>Outreach Programs for Map Libraries</b><br/>Andrew Johnson, Free Library of Philadelphia</p>   |
| <b>10:30 - Noon</b>    | <p><b><i>SESSION D: Electronic Chart Display &amp; Information Systems</i></b> - Assembly Room</p> <p><b>History of ECDIS &amp; International Scope</b><br/>Mortimer Rogoff, Radio Technical Commission for Maritime Services</p> <p><b>U.S. Coast Guard and ECDIS</b><br/>Lee Alexander, U.S. Coast Guard</p> <p><b>U.S. Corps of Engineers and ECDIS</b><br/>Tony Niles, U.S. Corps of Engineers</p> <p><b>Legal Aspects and GIS Applications</b><br/>Fred Ganjon, Coast &amp; Geodetic Survey</p> |
| <b>Noon - 1:00 pm</b>  | <b>Lunch</b> (on your own)   |
| <b>1:15 - 5:00 pm</b>  | <p><b>Tours</b> (meet in Hotel Lobby)</p> <ul style="list-style-type: none"> <li>• NOAA/Coast &amp; Geodetic Survey/<br/>Aeronautical Charting Division</li> <li>• National Geographic Society</li> <li>• National Archives</li> </ul>   |
| <b>7:00 - 10:00 pm</b> | <p><b>Annual Banquet</b> - Ballroom</p> <p>Speaker: Dr. William B. Wood,<br/>The Geographer, Department of State</p>   |

## Friday, October 22

**8:00 am - Noon      Registration - Chesapeake Foyer**

**8:30 am - Noon      Exhibits/Posters Open - Potomac Room**

**8:30 - 10:00 am      *SESSION E: Cartographic Collage***  
Chesapeake Room

**A Decade of Transition for Academic Cartographic Facilities**

Claudia James and Joseph Stoll, Univ. of Akron

**How Practical are Minimum-Error Map Projections?**

John P. Snyder, U.S. Geological Survey (ret.)

**Cartography's Response to Changing Needs**

Grady B. Meehan, George Mason University

**8:30 - 10:00 am      *SESSION F: Computer Cartography 1***  
Assembly Room

**The Digital Base Map: Automating Cartographic Data for a GIS Use Community**

Margit L. Crowell, Southwest Florida Water Management District

**The Cartographic Challenges of Air Traffic Control Graphics for the Advanced Automation System**

Ronald M. Bolton, NOAA/Coast & Geodetic Survey

**Automated Terrain Shading for Micro-computer-Based Cartography: A Report**

James L. Sloan II, Penn State University

**10:00 - 10:30 am      Break**



**10:30 - Noon**

***SESSION G: Primary Processes of Global Environmental Change Documented From Space Since 1965***

Chesapeake Room

Michael R. Helfert - NASA Johnson Space Center

**Noon - 2:00 pm**

**Lunch & Annual Business Meeting**  
Ballroom

**2:00 - 3:30 pm**

**Exhibits/Posters Open - Potomac Room**

**2:00 - 3:30 pm**

***SESSION H: Historical Cartographic Perspectives***  
Chesapeake Room

**New Tools for the Study of Old Maps**

David W. Tilton, Univ. of Wisconsin-Milwaukee

**Power and Maps: A New Interpretation of the Maps in "The Gazetteer of Jiankang Prefecture" (1261 A.D.)**

Bangbo Hu, Univ. of Wisconsin-Milwaukee

**Cartography in Colonial Mexico & Guatemala: Making Maps Amidst Cultural Change**

Alex Tait, Equator Graphics

**2:00 - 3:30 pm**

***SESSION I: Computer Cartography 2***  
Assembly Room

**Congressional District Atlas: Production of a Digital Map Image**

Connie Beard, U.S. Bureau of the Census

**Automated Scaling and Insetting: A Conceptual Approach**

Gregory Yapundich, U.S. Bureau of the Census

**Visualizing the Health of Chesapeake Bay; Constructing an Interactive Interface**

David Howard and Alan M. MacEachren, Penn State University

**4:00 - 6:00 pm      NACIS Board Meeting - Quorum Room**

**7:30 - 10:00 pm      Reception and Tour - Meet in Hotel Lobby**  
Library of Congress  
Geography & Map Division

|                             |
|-----------------------------|
| <b>Saturday, October 23</b> |
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**8:30 - 1:00 pm      Field Trip - Meet in Hotel Lobby**  
Bus trip to Mount Vernon, Virginia and lunch at  
Gadby's Tavern, Alexandria, Virginia  
Ron Grim, Library of Congress

**2:00 - 4:30 pm      Workshop - Separated At Birth**  
Assembly Room  
Henry W. Castner, Dept. of Geography,  
Queen's University

**2:00 - 4:30 pm      Workshop - Cartographic Design in  
the World of Digits**  
Quorum Room  
Joel L. Morrison, U.S. Geological Survey

**6:50 - ?              Social Evening - Meet in Hotel Lobby**  
Dinner and/or drinks at local jazz club. Check NACIS  
Registration Desk for Details.

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*During the conference please make it a point to relax and socialize  
in the NACIS Conference Hospitality Suite (check at the NACIS  
Registration Desk for room location).*

## ABSTRACTS

**Wednesday 7:30 pm  
Opening Session**

**Keynote Speaker: Richard Furno, Washington Post**

The world of map making in newspapers and news magazines has changed dramatically since the introduction of the desktop computer. At the Washington Post about half the news graphics produced for the paper are maps. Four years ago, nearly all those maps were produced in the traditional way of ink on paper and cut screens. Today, all maps are produced on computers. The situation is similar in newsrooms throughout the country. Though production is faster and cleaner, that is only part of the story. Time constraints on news artists had never permitted original cartography for daily news. Today, mapping software allows cartographers to produce original, custom made maps to fit the needs of news stories.

**Thursday 8:30 - 10:00 am  
SESSION A: Animation in Cartography**

**Orientation Biases & Animated Maps-** Robert Lloyd and Rex Cammack,  
University of South Carolina

A number of studies have indicated locational information encoded into memory from maps represented with the traditional north at the top orientation is biased. For example, map readers rotated cognitive maps of the United States to north at the top before verifying that triads of cities were represented in correct or mirror patterns. Locations learned by navigating through a space appear to be encoded so that this bias does not occur. Some researchers have argued that the orientation bias is related to the type of spatial knowledge acquired when locations are encoded into memory. Distinctions have been made between survey and procedural knowledge and related to single or multiple vantage points. Other researchers have made distinctions between primary and secondary knowledge and whether the spatial information is directly or indirectly encoded from the environment. Other researchers have argued the frame of reference induced by scale changes causes the orientation effect and still others have argued the opportunity to encode nonaccidental features is critical for orientation free recognition. The purpose of this study was to investigate orientation bias for animated maps. The basic problem was to have subjects learn maps with seven objects at unique locations that could be identified by their shapes and

colors and then test the subjects for an orientation bias. Maps were animated in two ways. One set of subjects viewed a circular space from a vertical vantage point that had the seven symbols presented at fixed locations. The subjects learned the space while it rotated continuously on a monitor. This provided the same spatial information at many orientations. Another set of subjects experienced the same spatial information by having them experience a "walk through" animation from horizontal vantage points. Reaction time data were analyzed to determine if these two animation experiences produced an orientation bias.

### **Conceptualization & Planning of Map Animations**

Daniel Etter, GeoSystems and Martin von Wyss, Penn State University

GeoSystems of Lancaster, Pennsylvania was hired by Grolier Electronic Publishing, Inc., to produce a series of map-based animations for their New Grolier Multimedia Encyclopedia CD-ROM. IBEX Information Design of State College, Pennsylvania was hired to assist in the conceptualization, design and research for the project. The time frame for the project was approximately 120 days for the completion of thirty animations. In this short time period, GeoSystems and IBEX experimented with techniques that would apply to the new medium as we learned that many conventional approaches to static mapping do not apply to mapmaking for an electronic medium. Instead, a new set of techniques was explored to learn how to show spatial change over a span of time exploiting the new dimension of animation time. The limits imposed by the software involved in the production of the maps, the CD-ROM medium, and the minimal time allotted all put constraints on the final product, but the project showed that it is effective and feasible to depict spatial characteristics of historical events in this dynamic medium. The project director at GeoSystems will present the background for the map series, and a geography masters degree student at Penn State working with IBEX will discuss specific challenges presented by the medium and some of the properties of animation that demanded a new approach.

### **Map Animation: The Dynamic Variables Extended**

Alan M. MacEachren, Penn State University

A group of colleagues and I recently proposed an extension of Bertin's visual variable taxonomic/syntactic concepts into the realm of dynamic maps. Although Bertin explicitly stated that his principles concerning visual variables were not applicable to dynamic display, our initial explorations suggested otherwise (DiBiase, et al., 1991) In analyzing the applica-

bility of map animation to exploratory visualization in the earth sciences we found Bertin's contention, that time "introduces only one additional variable," to be wrong—if we treat variables in the same way as we have done for the static visual variables described above. Initial consideration and experimentation identified three *dynamic variables* for mapping. These are *duration*, *rate-of-change*, and *order*. Subsequent contemplation of the kinds of dynamic map manipulation (that should be) available to a geographic analyst, and viewing many more map animations, leads me to propose three additional dynamic variables, *display date*, *frequency* and *synchronization*. The resulting six dynamic variables can be defined as follows:

- 1) display date: the presence of a map mark in a specific frame.
- 2) duration: the length of time between two identifiable states.
- 3) order: the sequence of frames or scenes.
- 4) rate of change: the difference in magnitude of change/duration for each of a sequence of frames or scenes (or m/d).
- 5) frequency: number of identifiable states per unit time—temporal texture
- 6) synchronization (phase correspondence): the temporal correspondence of two or more time series.

According to the semiotician Morris, syntactics is the relation between a given sign vehicle (i.e., map symbol) and other sign vehicles. Following Bertin's syntactics for static visual variables, a syntactics of dynamic variable to referent relations can be suggested with appropriate kinds of data representation specified for each dynamic variable (e.g., order applied to ordered data). In addition to these structural relationships among map sign variables, animation presents issues of map syntactics that more closely parallel those of language syntax. When maps play out over time as a map movie, it may prove useful to borrow some ideas from film analysis to address the many new issues that arise. Among the most interesting approaches to film analysis having potential map animation applications is Metz's *filmic syntax*. His model (or typology) of 'syntagmatic types' characterizes the temporal-visual manipulation possible in film. This typology has some obvious application to map movies. A few of these will be presented.

**Thursday 8:30 - 10:00 am**  
**SESSION B: Cartographic Serendipity**

**Differences in Epistemological Beliefs and Map Interpretation**

Julio C. Rivera, Univ. of Wisconsin-Milwaukee

This paper explores the relationship between beliefs about what knowledge is and the resulting understanding and interpretation of maps. Do adults who believe knowledge is complex and contextual believe maps are complex and contextual? Does the use of a map promote simple or complex modes of thought? The theoretical basis of this work is an application of the study of cognition in adults and the study of cognitive structures beyond Piaget's formal operations, otherwise known as post-formal operations (Perry, 1970, Kitchener and King, 1981, Baxter Magolda, 1992). This area of research includes the study of ill-structured problems, which do not necessarily have a single solution. Resolution of such problems depend upon what the individual believes knowledge to be. Therefore these beliefs about knowledge may have an impact on how adults make meaning of maps. This type of theoretical and research approach is useful because real world map interpretation problems are similar to ill-structured problems. The paper will discuss applications to cartographic research.

**Categorizing the Cartographic Representation of Time**

Irina Vasiliev, SUNY College at Geneseo

Maps have been used to show people's relationships to their geographic space, to locate objects and places, and generally to convey many sorts of geographic information. Much of that information is not simply spatial but also carries with it the element of time. This temporal information comes in a number of forms and is symbolized in a number of ways. My research into time on maps has led to my development of categorization scheme into which fit different types of time. These categories are: 1) Dates: the dating of an event in space; 2) Duration: the duration of some occurrence in space; 3) Standard Time: the organization or standardization of space by time; 4) Time as Distance: the use of time as a measure of distance; and 5) Space as Clock: spatial relations as a measure of time. Each category has certain symbols or the use of cartographic elements that are consistently employed in the representation of the spatiotemporal information in question. This paper will discuss these categories of time on maps and examine the varying symbology used in their representation. Examples of time on maps will be presented. The results of this research will help in developing standard symbology appropriate to temporal information to be used in computer cartography and geographic information systems.

## **Education in a Multi-Disciplinary Environment**

Kit Fuller, U.S. Geological Survey

Exploring Maps, a packet of printed material developed by the U. S. Geological Survey for grades 7-12, teaches about the history of maps and mapping using a creative mix of images and words that invites nonlinear, associative thinking. Teachers and students can juxtapose different elements of the packet depending on the subject matter being taught and the classroom goals. Choosing elements to link together and using texts and images simulates the excitement of multimedia education. The printed format can be affordably produced and distributed to high schools. The elements of the packet include:-

- A 6-foot time line of maps, from 3,000 B. C. to the present.
- A do-it-yourself time line encouraging visual and verbal experimentation with historical events.
- A time line of texts including many primary writings on exploration, science, and mapping ranging from Homer's *Odyssey* to the Moon landing. These allow students to explore how people in other cultures and at other times have used and thought about maps.
- Four activity sheets in which students construct their own mapping tools, gather and analyze spatial data, make thematic maps, and write and think about how maps look and are used.

Because mapping is a skill used in many disciplines, the teaching packet can be used in the geography, English, art, history, math, and science curricula. It addresses many of the educational goals of the Geography Education Standards Project currently being developed by the National Council for Geographic Education.

**Thursday 10:30 - Noon**

***SESSION C: Cartographic Data and Map Librarians***

### **Evaluation of Programs for the Storage & Retrieval of Cartographic Data.**

Lisa A. Recupero, University of Missouri, Rolla

The study evaluates three software programs: GEODEX, ProCite and PC-CARTONET; and one CD-ROM product: GEOINDEX. The programs were evaluated for their use in University of North Carolina at Chapel Hill Map Collection to store and retrieve series-level cataloging information on cartographic data. The programs were evaluated on the following criteria: 1) ability to perform basic functions, 2) the interface, 3) efficiency, 4) ease of use, 5) access points, 6) special features (file size), 7) hardware required, 8)

attitudes of current users, and 9) cost. The evaluation recommended the purchase of GEODEX for the collection due to its efficiency and cost. PC-CARTONET was judged as the program best suited for the needs of cartographic data, but was not recommended due to financial considerations.

### **Outreach Programs for Map Libraries**

Andrew Johnson, Free Library of Philadelphia

Special collections in large libraries, both public and academic, are often-neglected resources which contain important materials for a variety of researchers. Particularly in times of declining and restrictive budgets, special collections need to develop effective outreach programs in order to prove their relevance and to acquire possible financial support from their clientele. In May of 1993, the Map Collection at the Free Library of Philadelphia presented a seminar highlighting historical land-use resources that are of special interest to environmental consultants, who are frequent users of our collections. Using sign-in sheets to compile a mailing list database over a year's period, we sent formal invitations to about 200 individuals from about 100 environmental consulting companies to attend the morning seminar. With over 60 attendees and positive feedback from the response sheets, the seminar was a success.

This paper will outline the methods used to organize this outreach and educational seminar, a description of the program, and the results.

**Thursday 10:30 - Noon**

***SESSION D: Electronic Chart Display & Information Systems***

### **History of ECDIS & International Scope**

Mortimer Rogoff, Radio Technical Commission for Maritime Services

### **U.S. Coast Guard and ECDIS**

Lee Alexander, U.S. Coast Guard

The eventual employment of Electronic Chart Display Information Systems (ECDIS) will significantly effect all aspects of maritime navigation, piloting and safety. The U. S. Coast Guard is the lead United States maritime authority responsible for regulating the operation of commercial vessels engaged in U.S. trade. There are significant policy and regulatory implica-



tions associated with ECDIS related to system specification, shipboard installation, performance standards, training, certification, and the means to update electronic charts. The U. S. Coast Guard is conducting a comprehensive test and evaluation (T & E) program to assess the operational capabilities and limitations of current and prototype ECDIS systems and proposed performance standards. Two important aspects of this program include the Coast Guard's participation in the U. S. ECDIS Testbed Project, and the establishment of a Joint USA - Canada Cooperative Research Program on ECDIS. An update on the status of the U. S. ECDIS T & E program and results of the trials and experiments will be presented.

### **U.S. Corps of Engineers and ECDIS**

Tony Niles, U.S. Corps of Engineers

### **Legal Aspects and GIS Applications**

Fred Ganjon, Coast & Geodetic Survey

ECDIS provides some interesting legal implications since, by definition, ECDIS must be the equivalent of the paper chart. The paper chart is accepted as a legal document by courts in the United States and other foreign nations. Does this mean that ECDIS will automatically be accepted as a "legal document"? What are the implications of this? What are the ramifications of the several bills that have been introduced in Congress that would require certain ships to carry an ECDIS? The data base necessary for ECDIS to be functional also will provide input to GIS about the near-shore marine environment. This may be the beginning of a marine GIS using nautical chart data bases.

**Thursday, 7:00 - 10:00 pm**  
**Annual Banquet**

### **Dr. William B. Wood**

The Geographer, Department of State

Dr. Wood is Director, Office of the Geographer, Bureau of Intelligence and Research, U. S. Department of State. He received his undergraduate degree from the University of California at Berkeley and his PhD. from the University of Hawaii. His graduate research focus—sponsored by the Population Institute, East-West Center—was on urbanization and regional development, particularly in Southeast Asia. In 1985, he joined the Office of the Geographer as a geographic analyst. Since 1990, he has served as the Geographer for the Department of State and is responsible for research and

current intelligence analysis on a wide range of "global issues": boundary and territorial disputes, refugee and migration flows, population trends, ethnic distribution, transboundary environmental and resource problems, and United Nations activities. His office's Cartography Division provides guidelines to all federal mapping agencies on the proper depiction of international boundaries and foreign place names on all USG maps. The Office of the Geographer also produces thematic maps used in Department of State publications and in briefings for the Secretary and other senior foreign policy makers.

**Friday, 8:30 - 10:00 am**  
***SESSION E: Cartographic Collage***

### **A Decade of Transition for Academic Cartographic Facilities**

Claudia James and Joseph Stoll, Univ. of Akron

The introduction of powerful, personal computers capable of creating high quality graphics has significantly affected the production of graphic information in the past decade. The effects of this technology have been felt by many university cartographic production facilities. This study will explore changes in the production methods and function of cartographic facilities within the university setting as a result of this new technology. The character and extent of this transformation will be analyzed by conducting a survey of cartographic facilities at various universities. Among the issues to be addressed:

- Are laboratories losing their niche on campus due to other departments purchasing their own hardware and software to perform tasks formerly done in cartographic facilities?
- What are the specializations that continue to make cartographic production facilities necessary?
- How do cartographic laboratories balance teaching and production?
- Is there still a place for the instruction and use of manual production methods?
- Can traditional sources provide sufficient funds for cartographic facilities to maintain highly technical equipment?

Survey answers will be tabulated to determine what changes have occurred in the last decade and how cartographic facilities are adapting to the changes. Results will be the basis of a panel or round table discussion of this topic.

## **How Practical are Minimum-Error Map Projections?**

John P. Snyder, U.S. Geological Survey (ret.)

Ever since the Mercator projection gained wide acceptance for general geographic world maps, there have been attempts to replace it because of its serious area distortion. Some, like the Van der Grinten and Miller Cylindrical projections, have been proposed because of their similarity to the Mercator. Other proposals for minimum-error world maps use criteria which lead to maps looking too unusual for much acceptance. Several such projections have been presented from 1870 to 1992. World map projections with low overall distortion, such as the Robinson and Goode Homolosine, remain more acceptable without meeting any mathematical criteria for minimum error, aside from equality of area in some cases. There is more justification for minimum-error regional map projections, such as those for which the map region (rectangle or landmass) is approximately bounded on the projection by a line of constant distortion. Such projections that are also conformal have appeared from 1953 to as recently as last year. Several equal-area projections have been designed with similar minimum-error attributes. There are also projections which minimize overall errors in distance measurement. Most of these minimum-error projections are difficult or nearly impossible to construct without a modern computer. Does this negate their use? Probably, if most users need to digitize from the maps or need to do their own programming of formulas. No, if the goal is to make the map easier for measurement of distance, area, and shape. We too often still choose projections to suit pre-computer criteria involving ease of construction, rather than to meet the needs of the map user.

## **Cartography's Response to Changing Needs**

Grady B. Meehan, George Mason University

Recent technological developments in cartography are changing the nature and expanding the perspective of the cartographer. With the automation of map making, new opportunities are developing as geographic information systems technology is becoming an accepted means of mapping and analyzing spatial data. Cartography must support existing demands and create new opportunities in a rapidly changing world. The growing demand for geographic information systems in scientific and management applications, new questions related to problems of cartographic error and accuracy pose new challenges. User interface problems pose additional questions about how we use maps and how our preferences can be included in automated systems. The increasing emphasis on spatial data analysis provides a challenge for cartography to develop new cartographic approaches to these data analysis problems. New demands come not only from geography but from other disciplines. Cartographers now serve a

wider audience, beyond geography, and must be prepared to be partners in scientific research over a wider variety of disciplines. Collaborative relationships between cartographers and other scientific researchers will provide new opportunities contributing to professional growth and the enhanced status of the profession. Questions of professional collaboration and client relationships have been addressed frequently in the statistical literature and could serve as a model for cartographers. With new and changing needs for cartographic expertise created by automated mapping and geographic information systems, issues of collaboration and consulting should be included in cartographic education.

**Friday, 8:30 - 10:00 am**

***SESSION F: Computer Cartography 1***

**The Digital Base Map: Automating Cartographic Data for  
a GIS User Community**

Margit L. Crowell, Southwest Florida Water Management District

The creation of a base map suitable for a wide spectrum of users involves the consideration of both practical and aesthetic issues. If a map is to satisfy the cartographic needs of many diverse users, and allow for efficient and economical updating, practicality dictates that the mapped data be in a form that is well organized and easily manipulated. At the same time, the majority of map users want a product that is not only functional but visually appealing as well. A Geographic Information System (GIS) provides an ideal framework within which to design, develop, and maintain a digital base map. The digital base map developed at the Southwest Florida Water Management District meets these requirements for District staff. In addition to its use in generating a high-quality standard hardcopy reference map of the District and surrounding area, the mapped information may be combined with other project-specific digital data and manipulated in virtually limitless ways to produce maps for special reports and presentations. This is easily accomplished by even a novice GIS user via a menu interface developed as an accompaniment to this dataset. When used together, the digital data and custom software tools provide a "kit" with which the user may construct finished maps to his/her specifications. The data are stored as individual thematic layers in a digital map library. This method of data organization allows easy access to mapped data for all District GIS users. The development of this base map has yielded significant time savings for cartographic data users at the District, and has helped to standardize and control the quality of the mapping products produced by this agency.

## **The Cartographic Challenges of Air Traffic Control Graphics for the Advanced Automation System**

Ronald M. Bolton, NOAA/Coast & Geodetic Survey

In 1981, the Federal Aviation Administration (FAA) devised a comprehensive plan for improving air traffic control, airway navigational facilities and services. The most ambitious and complex undertaking of this plan is the Advanced Automation System (AAS) which will totally upgrade the entire air traffic control system; the AAS is designed to handle traffic loads well into the 21st century. AAS will include new tower radars, map and chart displays, and common console equipment for both enroute and terminal operations. The AAS concept was developed to deal with increasing demands for aviation services through increased automation. Today, over 430 million people per year utilize the National Airspace System (NAS) and that figure is projected to increase at a rate of 5% a year; over 700 million people will use the NAS within ten years. The National Ocean Service (NOS) will supply thousands of crucial aeronautical charts and maps in digital form to support and maintain the AAS. The NOS is currently delivering prototype data to the AAS project for use with Initial Sector Suite System (ISSS). The ISSS will provide enroute air traffic controllers with new workstations called common consoles (CCs); these 7,500 consoles will display maps/charts on a high resolution, multi-color, graphics monitor. The AAS will later involve the installation of 2300 position consoles at 335 FAA Air Traffic Control Towers. The challenge of delivering vast numbers of high quality charts and maps in digital form on such a rigid schedule is unprecedented. Several cartographic challenges will be faced as the NOS supplies the digital charts and maps to the AAS. Data handling will be a staggering task; the data capture, data manipulation, and formatting of the data for delivery to the FAA will involve many gigabytes of data each month. The cartographic generalization problem will present the greatest challenge; magnification, reduction, data selection, and the associated elements of cartographic generalization—simplification, classification, symbolization, and induction—will require careful attention in supplying the critical data for safe aeronautical navigation to the AAS.

### **Automated Terrain Shading for Micro-computer-Based Cartography: A Report**

James L. Sloan II, Penn State University

Terrain shading is an informative and appealing feature of fine maps. Until recently, however, automated terrain shading has been inaccessible to most cartographers who have adopted microcomputer-assisted methods. Marin (1993) demonstrated that shaded relief images generated in a Geographical Information System (GIS) package can be integrated with maps produced

in microcomputer-based PostScript illustration software, but file format and platform incompatibilities forced a solution that is too complex for routine application. It is my goal to make convenient the integration of shaded relief images into illustration and multimedia environments. In particular, I aim to batch-produce multiple, high-resolution TIFF images which can be incorporated into fly-by map animations. The commonly recognized TIFF format will allow importation of files into the desired microcomputer-based graphics environment. I will be evaluating and reporting on the GRASS and ARC/INFO software packages as terrain shading engines on the basis of batch processing capabilities, quality of output image, number of map projections available, and convenience of file exportation. The source for digital elevation data is the NOAA 5-minute gridded elevation/bathymetry data set for the world, and the GIS software is implemented on the UNIX-based SUN Workstation.

**Friday, 10:30 - Noon**

***SESSION G: Primary Processes of Global Environmental Change  
Documented From Space Since 1965***

Michael R. Helfert - NASA Johnson Space Center

This paper has two primary objectives:

1. familiarization of this leadership group with the quality and disciplinary scope of the 200,000+ frames of Earth photography acquired during NASA spaceflights since the Mercury program. In this portion of the speech cataloging and indexing of the above data will be reviewed as well as remote access information to the electronic megdata database and sample digitized data. Instructions for acquisition of data in a variety of formats (videodisk, CD-ROM, film, hardcopy, digital download via remote computer) will be provided to the audience.
2. a review of the primary global environmental change processes (atmospheric transparency and constituents changes, biomass burning, desertification, transcontinental and transoceanic dust transport, deforestation, soil fertility decreases and erosion, hydrologic/limnologic and estuarine/littoral changes, and urbanization/migration) that are quantifiable in Earth photography time series dating from 1965. Examples will be drawn from all continents and major island groups. Latitudinal focus will be on the global tropics, especially changes in Latin American, Sub-Saharan African, South Asia and Indonesia. Some few examples will illustrate analogous changes underway in portions of North America and Russia.



**Friday, 2:00 - 3:30 pm**

***SESSION H: Historical Cartographic Perspectives***

**New Tools for the Study of Old Maps**

David W. Tilton, Univ. of Wisconsin- Milwaukee

Much of the post-Columbian history of North America has been about the contestation of territory conceived and represented in maps. While European-style maps are the subject of a high scholarly literature, American Indian maps—though vital in the description and understanding of the native world—remain under-studied, unexplored, and at times undiscovered to most researchers. Such maps are indeed among the most precious intellectual records of the Indian and Inuit civilizations of North America. Surviving examples, scattered in a large number of libraries, archives, museums, and private collections throughout North America and Europe, are cataloged as maps, manuscript documents, and ethnological artifacts. Consequently, they are currently not available for study as a coherent corpus of information. A project, funded by the National Endowment for the Humanities, is currently underway at the University of Wisconsin-Milwaukee to create a research oriented digital archive and database of North American Indian and Inuit Maps on CD-ROM. The archive is intended as a research tool for scholars studying the cartography, landscape perceptions, cognition, art, and history of American Indians; as well as serving as a curatorial tool. The CD-ROM will contain extremely high resolution digital images (scanned photographic transparencies) and catalog information (data and cartobibliographies) for all available examples of North American Indian and Inuit maps. The images and catalog information will be linked through an intuitive and easy to use hybrid hypermedia/relational database. The creation of this digital archive will bring together a large corpus of maps (approximately 400) that previously have not been available in any single location, and allow those maps to be accessed, related and organized based on a wide range of available criteria. It will also provide a map format (digital) that allows researchers to magnify and manipulate the images for detailed analysis, overlay one map onto another, select and isolate features on maps for comparison, create symbol libraries, etc. This paper discusses the organizational and technological structure of the archive, and how tools such as this can help scholars open new avenues of research for the study of old maps and their meaning.

## **Power and Maps: A New Interpretation of the Maps in "The Gazetteer of Jiankang Prefecture" (1261 A.D.)**

Bangbo Hu, Univ. of Wisconsin-Milwaukee

In the field of the history of cartography, studying maps in their cultural milieu began only recently. Approached from the relevant cultural theories and method of iconographical analysis, this paper explores how political power influenced the maps in The Gazetteer of Jiankang Prefecture, a well-known Chinese gazetteer of the Song dynasty (960-1279 A. D.). These maps are examined more for their cultural images than for their detailed cartographic technology. Specifically, this exploration addresses the following questions. Who initiated and organized the production of the gazetteers and their maps and for what specific purposes? How much freedom did the map makers have to decide the contents and style of the maps? How do the titles, elements, symbolization, and actual selection of maps reflect political power? By the above discussion, it is concluded that maps may be viewed not only as geographical representations of the spatial world but also as cultural images which reflect the societies in which they are produced.

## **Cartography in Colonial Mexico & Guatemala: Making Maps Amidst Cultural Change**

Alex Tait, Equator Graphics

In the paper, I examine the style and content of the maps of the *Relaciones Geográficas* of 1579-1586 from Mexico and Guatemala. A royal decree for a survey of the lands of the King of Spain elicited these maps from settlements in Spanish Central America. They reflect many aspects of the merging of two disparate cultural traditions (European and indigenous) prevalent in the changing colonial society. After a brief examination of the entire group of maps (76) of the *Relaciones Geográficas*, I focus attention on three particular examples, maps of the towns of: Mexitlán, Atitlán, and Zapotitlán. The detailed analysis of these images looks not only at the superficial graphic construction of the map but also into the forces affecting the artist's overt and covert communication of information through the map. The discussion of the maps is based in the historical, political and social context of individual artists and locations and involves the following themes: 1) role of graphic tradition, 2) influence of the artist and the other individuals involved in responding to the King's survey, 3) the effect of the specific questions in the survey, and 4) the more subtle influence of the military, spiritual and social interaction between Spaniards and Indians in the evolving colonial society. The analysis of these images demonstrates the means by which individuals encode local political conflict and change into the iconography of a map of their community



**Friday, 2:00 - 3:30 pm**  
**SESSION I: Computer Cartography 2**

**Congressional District Atlas: Production of a Digital Map Image**

Connie Beard, U.S. Bureau of the Census

The U. S. Bureau of the Census recently published the *Congressional District Atlas for the 103rd Congress of the United States*. Approximately 935 pages of one or more unique maps were contained in the two volume set. The mapping system used to produce those maps combined manual interactive edit of names for enhanced map image and an automated process based on mapping algorithms written by cartographers. Because of time constraints, the goal was to achieve the most time efficient mix of manual and automated procedures. The cartographic product, a congressional district digital map image metafile, allowed flexibility for output to devices ranging from computer screens to high resolution plotters that produced printer-ready, screened composite film. The project spanned approximately thirteen months from map design to bound volume. Actual map production took only six months. The success of this mapping system and the resulting digital cartographic metafile product are key stepping stones for future map product development.

**Automated Scaling and Insetting: A Conceptual Approach**

Gregory Yapundich, U.S. Bureau of the Census

The automated mapping system used by the Geography Division at the U. S. Bureau of the Census currently has the capability to perform automated scaling and inseting. The methods implemented for determining scaling and inseting are based on quantification of feature density. This system was used to produce an extensive array of map products to support 1990 decennial census activities. Production of this large array of map products, however, revealed limitations in the current system and suggested areas for improvement. This paper will describe the algorithms for automated scaling and inseting used in the production of maps for the 1990 decennial census. It will explore avenues where these algorithms can be improved. It will also examine the underlying principles which guide the application of these computer algorithms to various map types and map production systems.

## **Visualizing the Health of Chesapeake Bay; Constructing an Interactive Interface**

David Howard and Alan M. MacEachren, Penn State University

This presentation reports on the development of an interactive interface designed to aid in exploratory data analysis and error visualization. This research project was initiated by the NCGIA Visualization of Data Quality Challenge. The Challenge emphasizes time-space visualization of dissolved inorganic nitrogen in the Chesapeake Bay. The interface should allow the visualization of the data surface as it changes over time and should incorporate several interactive methods of visualization of uncertainty in the data. The development platform used is IMSL/IDL. IDL provides flexible tools for designing custom interactive user interfaces and allows a wide range of data manipulation possibilities. We have IDL running under UNIX on Sun Sparcstations. Previous research has pointed to two questions that must be addressed when making information about uncertainty available in an interactive visualization environment. These questions are: 1) what kind of user interface is most effective and 2) what graphic variables are appropriate for showing different kinds of uncertainty. In this presentation we will focus on the first of the two questions. With its 'widgets' to construct interfaces, IDL provides an environment to explore interactive interfaces easily. We will demonstrate with slides and, perhaps a video, a typical exploratory session using the interface developed.

**Saturday, 2:00 - 4:30 pm  
Workshops**

### **Separated at Birth**

Henry W. Castner, Dept. of Geography, Queen's University

A hands-on workshop in which participants will be asked to confront and execute the graphic imperatives necessary to produce distinctive graphic representations. Within the continuum of processes from symbolization to cartooning to caricaturing to portraiture, some typical geographic and cartographic problems will be discussed. Participants will then make caricatures of two famous American cartographers. No previous experience with caricaturing or portraiture is required but participants **MUST DRAW!**

### **BACKGROUND**

A small picture book, Separated at Birth?, juxtaposes pairs of photographs of famous look-a-like personalities and wonders if they could be related?

Implicit in their comparisons is that one photograph could stand for two people, i.e. the photographs are essentially interchangeable! But why do we see these people as related? How are their faces the same? How are they different? If we wish to produce non-interchangeable representations, how do we proceed? Clearly we must determine what features and relationships are important in the recognition of each face. We do this routinely in the design of map symbols by isolating and exaggerating a critical dimension or attribute of the object being symbolized. As we make our symbols more pictographic, we preserve more and more detail and thus the explicitness of the object being represented. Similarly, in working with human faces, we identify three levels of replication: cartoons, which preserve general human features or traits; caricatures, which while being generalized, are specific to individuals; and portraits, which convey all the detail of the photograph. Only with caricatures are we confronted with isolating those features critical to recognition. The generalization of familiar geographic shapes for replication at extremely small scales raises similar questions of procedure and feature selection. However, the abstract and impersonal nature of this makes it relatively easy to accomplish; this is not so true of the face of a friend and colleague. The workshop is designed to place its participants in the predicament of having to make important decisions about the omission, retention and exaggeration of facial features so as to preserve the distinct recognizable character of the two different (but related?) subjects.

### **Cartographic Design in the World of Digits**

Joel L. Morrison, U.S. Geological Survey

This workshop will emphasize basic cartographic design philosophy applied to visualizations of digital spatial data in a PC or workstation environment. The tool kits available for the user to create graphic displays from digital spatial data are ever increasing in both number and capability. Most developers are not trained in cartography. Why should the resulting visualizations not be aesthetically pleasant as well as informative?

**Background:** No formal training in cartography will be assumed. Some familiarity with PCs and/or workstations will be assumed. A knowledge and desire to utilize digital spatial data is required. A love of maps is critical.



# **NACIS XIV**

**Ottawa, Canada**

**August 9 -13, 1994**

Next year's NACIS conference will be held jointly with the  
Canadian Cartographic Association.

We hope all of you can join us.