# NACIS VII
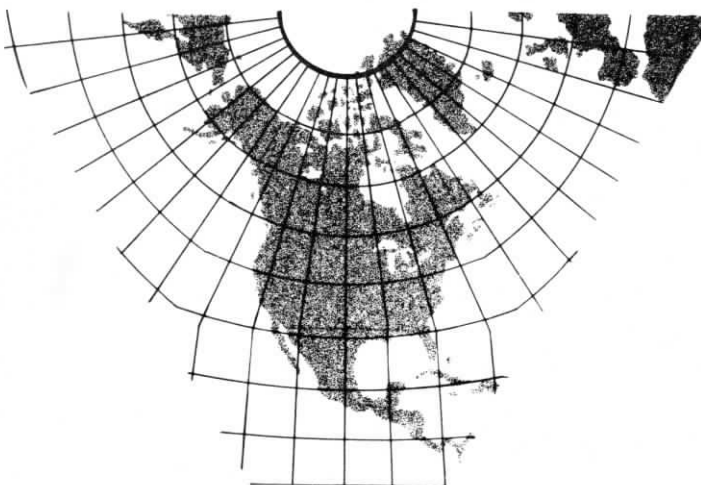
## PROGRAM and ABSTRACTS

"NEW DIMENSIONS IN CARTOGRAPHY"

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NORTH AMERICAN
CARTOGRAPHIC INFORMATION
SOCIETY

SEVENTH ANNUAL MEETING

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**ATLANTA**

Radisson Inn & Conference Center

OCTOBER 28-31, 1987

Radisson Inn and Conference Center
Atlanta, Georgia
October 28-31, 1987

Conference Participants:

Welcome to Atlanta, the site for the seventh annual meeting of the North American Cartographic Information Society. NACIS VII is designed to further the Society's objective of improving communication, co-ordination, and co-operation among cartographic professionals from government, academic, and private organizations.
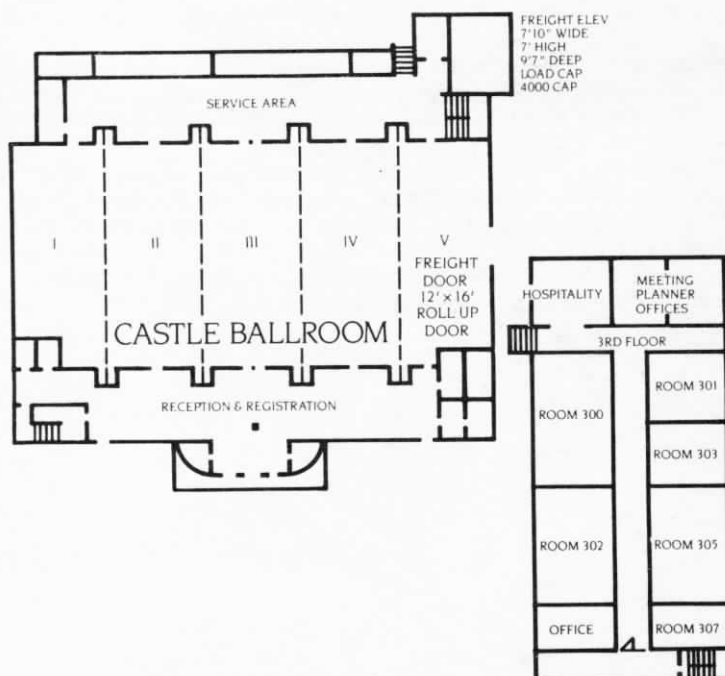
The theme of this year's meeting, NEW DIMENSIONS IN CARTOGRAPHY, is reflected in various special as well as paper sessions. One of the major new dimensions in cartography involves the rapid change in cartographic technology at all levels that is being driven by the media, or computer revolution. Sessions devoted to automated cartography and computers in university cartographic labs directly address this theme. Other sessions also show the effects of the media revolution, but in less direct ways. Other sessions address new developments and research in the many sections of the map information community.

I hope you will have the opportunity while you are in Atlanta to look over the hub of the South. Atlanta is one of the fastest growing areas in the United States and is the major cultural and financial center of the U.S. Southeast.

I would like to thank all the members of the 1987 Conference Committee and the Executive Board, who assisted in the planning and organization of NACIS VII. I am very grateful to the many speakers, organizers, and participants in this year's program for their enthusiasm and cooperation.

Thank you for attending and participating in NACIS VII.

Johnnie D. Sutherland
NACIS VII Conference Director

OFFICE

ASHFORD

MEN

PACES COURT

LADIES

BRIARCLIFF

HOSPITALITY

MEETING PLANNER OFFICES

2ND FLOOR

CLAIRMONT

PACES EAST

PACES BALLROOM

DUNWOODY

HABERSHAM

ROOM 200

ROOM 201

ROOM 203

PACES WEST

ROOM 202

ROOM 205

STORAGE ROOM

EMORY

GREENBRIAR

LENOX

PIEDMONT

ROOM 202

ROOM 204

ROOM 207

ANSLEY

BUCKHEAD

FREIGHT ELEV
7'10" WIDE
7' HIGH
9'7" DEEP
LOAD CAP
4000 CAP

SERVICE AREA

I    II    III    IV    V

CASTLE BALLROOM

FREIGHT DOOR
12' x 16'
ROLL UP DOOR

HOSPITALITY

MEETING PLANNER OFFICES

3RD FLOOR

RECEPTION & REGISTRATION

ROOM 300

ROOM 301

ROOM 303

ROOM 302

ROOM 305

OFFICE

ROOM 307

# CONFERENCE NOTES

Registration:

The Registration Desk is located in the Paces Court area on the second floor of the Radisson Inn and Conference Center. Registration hours are:

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|---|---|
| Wednesday | 1:00 p.m.–7:30 p.m. |
| Thursday | 8:00 a.m.–1:00 p.m. |
| Friday | 8:00 a.m.–4:00 p.m. |
| Saturday | 8:00 a.m.–11:30 a.m. |

The registration fee for the entire conference includes:

Conference packet
Conference program with abstracts
Admission to exhibits
Admission to all formal sessions
Choice of one field trip
Annual Banquet
Annual Luncheon
Refreshment breaks

Individuals are responsible for their own expensives for cash bars at receptions.

Field Trips:

Registration for field trips will be handled at the Registration Desk. Four field trips are being planned for NACIS VII. Please check at the Registration Desk for descriptions of the field trips, sign-up sheets, and departure times and locations. Several of the field trips will have size limits so please check at the Registration Desk to see if you made the cut for the trip you signed-up for on your registration form. You may have to make a second choice or put yourself on a waiting list. If you decide not to go on a particular field trip you have signed-up for please let the Registration Desk know so we can put an alternate on the trip.

Exhibits:

The exhibits will be set-up in the Paces East room on the second floor of the Radisson. Exhibits will be open:

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|---|---|
| Thursday | 9:00 a.m.–Noon |
| Friday | 9:00 a.m.–3:00 p.m. |

# NACIS VII

# NEW DIMENSIONS IN CARTOGRAPHY

## WEDNESDAY, OCTOBER 28, 1987

1:00–7:30 p.m.    REGISTRATION – Paces Court

1:00–7:00 p.m.    EXHIBITS SETUP – Paces East

3:00–7:00 p.m.    POSTER SESSIONS SETUP – Paces Court

1:00–3:00 p.m.    NACIS COMMITTEE MEETINGS

3:00–5:00 p.m.    NACIS BOARD MEETING – Clairmont

7:00–9:00 p.m.    OPENING SESSION – Greenbriar

WELCOME
Frank Drago, Local Arrangements Director

NACIS VII – NEW DIMENSIONS IN CARTOGRAPHY
Johnnie D. Sutherland, Conference and
Program Director, University of Georgia

PRESIDENT'S ADDRESS
Jeff Patton, University of North Carolina at Greensboro

KEYNOTE ADDRESS
Timothy J. Crimmins, Georgia State University

9:00–11:00 p.m.    NACIS RECEPTION and CASH BAR – Paces Court

9:00–11:00 p.m.    POSTER SESSION – Paces Court
Organizer: Donna Schenstrom, University of Wisconsin-
Milwaukee
Participants:
    James R. Anderson, Jr.
    Peter Krafft
    Florida State University

    Onno Brouwer
    University of Wisconsin

    Will Fontanez
    University of Tennessee

    Jefferson Simpson
    University of North Carolina-Charlotte

Cartographic Laboratory
Georgia State University

James Ingram
University of Georgia

Christopher Mueller-Wille
Texas A&M University

Gyula Pauer
University of Kentucky

Donna Schenstrom
University of Wisconsin-Milwaukee

Charles Traylor
Memphis State University

Jerry Ulrey
University of South Carolina

Ellen White
Michigan State University

Art Ziegler
Wisconsin State Cartographer

9:00–11:00 p.m.    GENERAL POSTER SESSION – Paces Court

*A Geographic Information System to Update Regional Land Use Plans in Richland County, South Carolina*
Richard Lacy, South Carolina Land Resources Commission

*Groundwater in Wisconsin*
Mike Czechanski, Wisconsin Geological Survey

### THURSDAY, October 29, 1987

8:00–1:00 p.m.    REGISTRATION – Paces Court

9:00–Noon    EXHIBITS OPEN – Paces East

8:30–10:00 a.m.    PAPER SESSION: CHILDREN AND MAPS – Emory
Chair: Jeffrey C. Patton, University of North Carolina-Greensboro

*Can Young Children Use Maps to Navigate?*
Scott M. Freundschuh, SUNY at Buffalo

*Children's Map Memory and Type of Basemap*
Carol A. Gersmehl, University of Minnesota

*The Young Child's Understanding of Maps As Representation*
Roger M. Downs and Lynn S. Liben, Pennsylvania State
University

8:30–10:00 a.m.　　PAPER SESSION: ATLASES – Greenbriar
Chair: Borden Dent, Georgia State University

*Equipment Requirements for An Atlas Project*
Roy R. Doyon, University of Massachusetts

*Historical Atlas of Canada*
Geoffrey Matthews, University of Toronto

*Finnish Thematic Atlases: An Examination of Their Content and
Methodology*
Pentti Yli-Jokipii, University of Turku

*Anatomy of An Atlas Buyer*
Howard Schretter, University of Georgia

10:00–10:30 a.m.　　REFRESHMENT BREAK IN EXHIBITS – Paces East

10:30–Noon　　PAPER SESSION: AUTOMATED CARTOGRAPHY –
Greenbriar
Chair: James O. Minton, University of Arizona
*Automated Radar Video Map Generation at NOS*
Ronald Bolton and Russell Hoover, National Oceanic and
Atmospheric Administration/National Ocean Survey

*Video Disk Mapping for the Southeast*
Michell Bring, Still Current Design, Inc.

*Musical Road Maps: Map Storage on Audio Media Since 1910*
Robert L. French and Donald F. Cooke, Consultant/Geographic
Data Technology

*The North American Street Map: Developing A Navigable
Database*
Barry W. Karlin, Karlin & Collins, Inc.

10:30–Noon　　THEMATIC PAPER SESSION: TEACHING
INTRODUCTORY CARTOGRAPHY – Emory
Organizer: Paul F. Rizza, Slippery Rock University

Norman Drummond, McGill University
Deborah King, University of Akron
William Kory, University of Pittsburg at Johnstown
Robert Sechrist, Indiana University of Pennsylvania

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| 1:00–5:00 p.m. | FIELD TRIP A: Walking Tour of Downtown Atlanta<br>FIELD TRIP B: Driving Tour of North Atlanta Development<br>FIELD TRIP C: Jimmy Carter Center<br>FIELD TRIP D: Cartographic Centers of Atlanta |
| 6:00–7:00 p.m. | RECEPTION AND CASH BAR – Castle Ballroom |
| 7:00–9:00 p.m. | ANNUAL BANQUET – Castle Ballroom<br>Banquet Address: *Landscape Artists and Scientific Expeditions in Early 19th Century America*<br>Sanford H. Bederman, Georgia State University |
| 9:00 p.m. | RECEPTION AND CASH BAR – Castle Ballroom |

**FRIDAY, October 30, 1987**

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|---|---|
| 8:00–4:00 p.m. | REGISTRATION – Paces Court |
| 9:00–3:00 p.m. | EXHIBITS OPEN – Paces East |
| 8:30–10:15 a.m. | PAPER SESSION: HANDLING CARTOGRAPHIC INFORMATION – Emory<br>Chair: Don Daidone, Rutgers University |

*CARTO-NET: An Integrated Cataloguing and Retrieval System for Map Library Automation*
Barbara Morris, University of Edinburgh

*Collection Development Policies for Cartographic Materials in Libraries*
Terri J. Robar, University of Miami

*Latin America: A Ghost of A Chance*
Danilo H. Figueredo, New York Public Library

*History of Aeronautical Cartography With Emphasis On The National Ocean Service Products*
Richard J. Comisky, National Ocean Service

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|---|---|
| 8:30–10:15 a.m. | PAPER SESSION: SYSTEMATIC CARTOGRAPHY – Greenbriar<br>Chair: Alan M. MacEachren, Pennsylvania State University |

*The Discrimination of Distortion Among Individual Cognitive Maps*
Robert Lloyd, University of South Carolina

*Region-Building and Cartographic Generalization: Mapping Roll-Call Votes in the U.S. House of Representatives As An Applied Example*
Ruth A. Rowles, University of Kentucky

*An Evaluation of Three Approaches to the Generation of
Digital Elevation Models From Contour Data*
D.J. Dudycha and J.D.E. Geddes, University of Waterloo

*Data Structures for Quadtree Addressed Geographic Entities On
A Spatial Relational Database*
Gregory A. Elmes, West Virginia University

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| 10:15–10:30 a.m. | REFRESHMENT BREAK – Paces Court |

10:30–12:15 p.m.    SEMINAR: LEGAL ASPECTS OF CARTOGRAPHY –
Greenbriar
Organizer: Ronald Bolton, National Oceanic and Atmospheric
Administration/National Ocean Survey

10:30–12:15 p.m.    THEMATIC SESSION: CARTOGRAPHY AND LATIN
AMERICA – Emory
Moderators:
    J. Hull McLean, U.S. Department of State
    Diana Huizar Rivera, Michigan State University

*Cartographic Development and Latin America*
Carlos Hagen, UCLA

*The PAIGH Program*
Monica Milam

*Cartographic Products and Their Utilization by the Grassroots
User*
Carlos Gonzalez Salman

12:15–1:30 p.m.    OPEN LUNCH

1:30–3:15 p.m.    PAPER SESSION: ATLAS PRODUCTION – Greenbriar
Chair: Ellen White, Michigan State University

*An Analysis of Design:* **The Atlas of Georgia**
Thomas W. Hodler, University of Georgia

*Printing and Binding Costs for State Atlases*
Dale Steele

*Production Guidelines for Producing Comparitive Urban Atlases*
James F. Fryman, University of Northern Iowa

*The Development of An Atlas Project*
Ute J. Dymon, University of Massachusetts

1:30–3:15 p.m.    PAPER SESSION: GENERAL CARTOGRAPHY – Emory
Chair: Pat Gilmartin, University of South Carolina

*What Happens When We Get Lost?*
Jeremy Crampton, Pennsylvania State University

*Promotion, Politics, and Provincialism: Map Marketing and Sponsorship in a Small City Environment*
Keith W. Rice, University of Wisconsin-Stevens Point

*Microcomputers and Cartographic Education*
Dennis Fitzsimons, Southwest Texas State University

*La Cartografia de la National Geographic Society* – El Mapa del Caribe en la Serie Cartografica "The Making of America"
Juan Jose Valdes, National Geographic Society

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|---|---|
| 3:15–3:30 p.m. | REFRESHMENT BREAK – Paces Court |
| 3:30–5:00 p.m. | ANNUAL BUSINESS MEETING – Greenbriar |
| 5:00–8:00 p.m. | OPEN |
| 8:00 p.m. | RECEPTION AND CASH BAR – Corvette's |

## SATURDAY, October 31, 1987

8:00–11:30 a.m.    REGISTRATION – Paces Court

9:00–11:00 a.m.    PAPER SESSION: CARTOGRAPHIC SYSTEMS – Emory
Chair: Ruth A. Rowles, University of Kentucky

*USGS Composite Theme Grid File and Norbeck's Allometric Growth Law*
Peter S. Pate, Pennsylvania State University

*A Totally Automated Map Production System for Census Maps*
Connie Beard, Bureau of the Census

*Implementation and Ongoing Operation of the Mississippi Automated Resource Information System (MARIS)*
Robert H. Smith, Jr., Mississippi Research and Development Center

*MAPBASE* – NOAA/Aeronautical Charting's Database of USGS Maps
Christine McNerney, National Oceanic and Atmospheric Administration

9:00–11:00 a.m.    SPECIAL SESSION: COMPUTERS IN UNIVERSITY CARTOGRAPHY LABS – Greenbriar
Organizer: Donna Schenstrom, University of Wisconsin-Milwaukee

Panel:
Hubertus Bloemer, Ohio University
Onno Brouwer, University of Wisconsin
Greg Chu, University of Minnesota
Frank Drago, Georgia State University
James Ingram, University of Georgia
Mike Lipsey, Michigan State University
Chris Mueller-Wille, Texas A&M University
Craig Remington, University of Alabama
Jim Young, University of Minnesota

11:00–11:30 a.m.    BREAK – Paces Court

11:30–1:00 p.m.    LUNCHEON – Castle Ballroom

1:00 p.m.    POST-CONFERENCE SOCIAL AT STONE MOUNTAIN

# ABSTRACTS

Paper Session: **Children and Maps (Emory)**
8:30–10:00 a.m., Thursday, October 29
Chair: **Jeffrey C. Patton, University of North Carolina at Greensboro**

### Can Young Children Use Maps to Navigate?
Scott M. Freundschuh
SUNY at Buffalo

There are opposing points of view as to the age at which children can read and use maps. Some studies indicate a low level of map reading ability in children attending fourth, fifth, and sixth grade, while others contend that children already know the skills of map reading and map use when they enter school. This study examines the ability of preliterate children, with the **proper instruction** and the **appropriate maps**, to use maps. An obstacle course was utilized in which the child, with the use of a map, attempted to navigate himself/herself through the course on a predetermined path outlined on the map.

It was found that some four-year-olds, and most five-year-olds could use a "proper map" to navigate an obstacle course. No formal conclusions were drawn concerning the ability of six-year-olds to perform this task. It was also demonstrated that all of the four-, five-, and six-year-olds who participated in this study were capable of extracting the necessary information from a map to enable them to navigate an obstacle course.

### Children's Map Memory and Type of Basemap
Carol A. Gersmehl
University of Minnesota

This study examines factors that affect the ability of children to remember locations on small-scale maps. The frames of reference provided by different basemaps and selected by children may affect their memory of locations. Geographers have discussed desirable basemap qualities in vague terms, saying that children prefer simple maps but also need "location hooks". Children in 14 classrooms (3rd and 4th grades) were asked to remember six locations (e.g., their school, downtowns, a suburban mall). They studied dot locations on three different basemaps: (1) colored areas representing **cities** (Minneapolis, St. Paul, suburbs), (2) lines representing major **roads**, and (3) a combination of **both** cities and roads—the most complex and differentiated basemap. From memory, the children placed dots on maps containing only the basemap framework. The accuracy of their dot placement suggests which frameworks were more useful for remembering locations.

### The Young Child's Understanding of Maps as Representations
Roger M. Downs and Lynn S. Liben
Pennsylvania State University

While one may disagree over a precise definition of map, no one would disagree that the essential property is representational. A map is a symbolic spatial representation that "stands for" part of the Earth's surface. When and how do children understand that a pattern of lines and colors or gray tones stands for a particular place?

There are two reasons for asking this obvious question. First, in the *Guidelines for Geographic Education*, there are 30 Suggested Learning Outcomes for the Kindergarten through Second Grade. Thirteen explicitly require the comprehension of a map: others are impossible without maps. Given this foundational role of maps, the second reason assumes great importance. There are theoretical grounds for believing the "stand for" relationship is *not* easily appreciated by young children. Piagetian theory sees representational thought as a gradual accomplishment emerging in the pre-operational stage. During this transition, coinciding with Kindergarten through Second Grade, there are limitations to children's logical thought. Thought is inflexible, concrete in character, and dominated by nominalism. Taken together, these properties constrain the child's understanding of maps as representations.

We will review empirical evidence on the extent to which children can interpret representations as standing for particular places. Using data from a range of tasks presented to 300 children aged 3- to 8-years, we consider this question at two levels. The *global level* deals with the relation between referent (space) and symbolic representation taken as a whole (map). The *componential level* concerns the ability to understand the relation between elements of the referent and elements of the representation. Both approaches suggest that maps are not immediately *transparent*, that children struggle to understand the "stand for" relationship, that their understanding is fragile and constrained, and thus that the understanding of the essence of a map is neither easy nor obvious.

**Paper Session: Atlases (Greenbriar)**
**8:30–10:00 a.m., Thursday, October 29**
**Chair: Borden Dent, Georgia State University**

### Equipment Requirements For An Atlas Project
Roy R. Doyon
University of Massachusetts

General reference state and thematic atlases are often produced in university settings. High costs associated with the printing component of an atlas can be limited by maximizing in-house production. Equipment requirements are directly related to the extent of in-house production and to the film types selected. The basic equipment and film choices associated with atlas production are reviewed and the specific equipment required to produce final pre-screened negatives in a "bright light" environment are presented. Sample budgets related to equipment options also are reviewed.

## Historical Atlas of Canada
Geoffrey Matthews
University of Toronto

Innovative and research oriented, the 70 double page plates of the Historical Atlas of Canada, summarizes the state of current academic research on varied topics such as geography, history, anthropology, economics, sociology, architecture and political science and displayed to advantage by cartography at its contemporary best. Each specifically designed map, graph or diagram is complimented by facsimilies or reproductions of contemporary maps and other illustrative material carefully chosen to represent various eras in Canadian history. Printed in 6 colours in both English and French editions and with advanced sales at a record high, "Volume I: From the Beginning to 1800" will change the way Canadians look at Canada.

## Finnish Thematic Atlases: An Examination of Their Content and Methodology
Pentti Yli-Jokipii
University of Turku

A detailed study is made of Finnish thematic atlases, principally the four existing editions of the *Atlas of Finland*, those of 1899, 1910, 1925 and 1960, and, for comparison, the *Atlas of Social Statistics of the Rural Communes in Finland* (1901), *Atlas of Finnish History* (1959), *Atlas of the Archipelago of Southwestern Finland* (1960) and *Atlas of Finnish Folk Culture* (1976). Each illustration, i.e. diagram or thematic map, in these works is reduced to its essential components and an analysis is made of the resulting variables: volume, topics, cartographic design, scale, areas described, areal units, points in time described and cartographic methods. The approach is a quantitative one to some extent, so that this work departs markedly from those surveys of research or presentational devices which are based only on intuition. The quantitative measures employed are the numbers of illustrations and their area on the pages of the atlases, problems of validity and reliability being obviated by the use of generalized diagrams to give the reader an impression of the results in relative terms rather than exact numerical tables. Finally these analyses are employed to build up a general picture of the nature of Finnish thematic atlases and of changes observable in the manner of their construction and the philosophies lying behind them.

## Anatomy of An Atlas Buyer
Howard Schretter
University of Georgia

Who buys a state atlas? Why? Is an atlas bought mainly as a reference volume or a book to be enjoyed? Can the data and information needs of different user groups be satisfied by the same Atlas? How long before an atlas is out-of-date?

Atlas makers, in response, usually are quick to enumerate their sales to readily identifiable markets, such as, schools, libraries and public officials. Most other purchasers, from business executives to retired elders, are lumped under the nondescript, general public. Assumptions about atlas preferences of this large, amorphous group and about overall atlas usefulness to all audiences, invariably are based on personal opinion, casual observation and hearsay.

To ascertain more definitive answers to these and related questions, purchasers of *The Atlas of Georgia* were randomly surveyed. Since virtually the entire 13,000 copy printing of this atlas

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was sold by direct mail, the survey sample represents the total atlas audience. Survey findings highlight the broad-based appeal of a state atlas, its disparate uses, and audience sophistication in interpretation of atlas content.

**Paper Session: Automated Cartography (Greenbriar)**
**10:30–Noon, Thursday, October 29**
**Chair:**

## Automated Radar Video Map Generation at NOS
Ronald Bolton
National Oceanic and Atmospheric Administration
Russell Hoover
National Ocean Survey

The National Ocean Survey (NOS), National Oceanic and Atmospheric Administration (NOAA), produces the Radar Video Map plates used by the Nation's air traffic controllers for close monitoring and vectoring of aircraft arrivals and departures. Since each plate is unique in both design requirements and items depicted, production of these plates through automation has presented uncommon challenges to the cartographer. This paper discusses these challanges and the current NOS capability for generating these complex maps through automated techniques.

## Video Disc Mapping System for the Southeast
Mitchell Bring
Still Current Design, Inc.

The entire U.S.G.S map series for the State of Georgia has been recorded on a single video disc. Projects are now underway to do the same for Alabama and Northwest Florida. These maps are combined with powerful microcomputer software that allows the user to "fly" around the state; zoom in on a particular location (down through the 1:250,000 to the 1:24,000 quad level) and use these base maps as a "light table" for analytical software overlays. This provides not only a natural archiving system, but eliminates the need for highly labor intensive and slow digitizing of maps for use in computer aided design systems.

## Musical Road Maps: Map Storage on Auto Media Since 1910
Robert L. French
Consultant
and
Donald F. Cooke
Geographic Data Technology, Inc.

Just as automobile drivers need paper road maps for conventional navigation, automatic navigation systems need road maps encoded in a form suitable for the particular navigation or route guidance technologies employed. Automobile navigation and route guidance systems have appeared sporadically for almost 80 years. Early mechanical systems used route map data in various forms including route instructions and landmarks printed on the perimeter of phonograph-like paper discs, and encoded by punched holes in metallic discs similar to those used in music boxes. Following these early patterns of paralleling storage approaches originally

developed for music, map data for contemporary automobile navigation systems are digitally encoded and stored on tape cartridges, tape cassettes, CD-ROM and DAT. This paper traces the development of automobile navigation and route guidance systems with particular emphasis on the techniques used for encoding and storing the supporting map data.

### The North America Street Map: Developing a Navigable Database
Barry W. Karlin
Karlin & Collins, Inc.

The race to build the definitive electronic street map for all major cities in North America is on. The value of such a street map is enormously enhanced when the map is not only descriptive, but also navigable. "Navigable" means that enough detail is provided on roadway characteristics (carrying capacity, turn restrictions, address ranges) to permit high quality routes to be plotted, given only starting and ending points. Such a computer-accessible database becomes the basis for products and services whose range is only now beginning to be imagined. Karlin & Collins has taken the lead in building a fully navigable, value-added database covering the 100 largest cities in the U.S. and Canada. Once complete, this electronic North American street map will be a unified, 20-gigabyte, continuously maintained online navigable database, accompanied by a comprehensive environment to support and exploit the data resource. This paper discusses the evolution of the requirements for and structure of this database and the parallel evolution of tools and techniques for its construction and management, including the strategy for funding what is estimated overall to be a $40 million development effort.

**Paper Session: Teaching Introductory Cartography (Emory)**
**10:30–Noon, Thursday, October 29**
**Organizer: Paul F. Rizza, Slippery Rock University**

Norman Drummond, McGill University
Deborah King, University of Akron
William Kory, University of Pittsburg at Johnstown
Robert Sechrist, Indiana University of Pennsylvania

The purpose of this session is to have cartography professors from different institutions, share the contents and methods employed in teaching introductory cartography at their respective college/university. A variety of opinions exist on precisely what should be taught in an introductory cartography course. Several different approaches to teaching are also employed by cartography instructors. Some courses focus more on laboratory experiences while others utilize a more traditional lecture approach. Classroom demonstrations, data collection and manipulation, computer use, and laboratory exercises are often important elements of an introductory course. A brief outline is presented below of the guide for participants in this session.

Course objectives
Relationship of course to program
Text(s), manuals, reading assignments
Teaching techniques
  Lectures
  Classroom demonstrations

Laboratory exercises
Tutorials
Evaluative techniques

**Paper Session: Handling Cartographic Information (Emory)**
**8:30–10:15 a.m., Friday, October 30**
**Chair:**

## CARTO-NET: An Integrated Cataloguing and Retrieval System for Map Library Automation
Barbara Morris
University of Edinburgh

**CARTO-NET** is a fully-functioning, automated map cataloguing and retrieval system, design-ed as a further cartographic enhancement to the MARC format. Using **CARTO-NET**, com-plete bibliographical control of all maps can now be achieved. The majority of map records have previously been difficult to automate because the map sheets were part of a series. (90% of all published maps belong in this category.) Cataloguing follows Anglo-American Cata-loguing Rules [AACR2] and Stibbe's manual of interpretation for cartographic materials [AACR2(CM)].

Graphic index diagrams showing map coverage, the map librarian's traditional tool for map cataloguing and searching have been automated. **CARTO-NET** has been linked with other geographically-referenced data sets such as gazatteer entries, air photographs and satellite ima-gery. This has opened up the potential for a very powerful, integrated information retrieval system to be established.

Automated cataloguing of all map sheets will be a major, but worthwhile task since it will enable map collections to be used more fully than they are at present. The British Library is currently supporting a feasibility study to set up a co-operative map cataloguing network, using **CARTO-NET**, within the UK to avoid duplication of data input. International telecom-munication standards are being observed so that the network can be extended overseas beyond the UK in the future.

## Collection Development Policies for Cartographic Materials in Libraries
Terri J. Robar
University of Miami

Budgets in most libraries are becoming tighter each year. Librarians are being called upon to justify their purchases of materials. A map librarian, especially one who is trying to build up a small map collection, may find it hard to justify many basic kinds of materials. She usually cannot point to a particular class or research project that will explain the need for such elemen-tary items as city street maps. If, however, there is a written policy for that map collection which explains in detail the way in which the collection will be built and the parameters which have been set for it, then the administrators of the library are better able to understand the needs of the collection.

At the University of Miami, we have just completed our collection development policy for car-tographic materials in the main library. As map librarian, I was chair of the committee which

wrote this policy. We addressed types of materials (maps, globes, imagery, etc.) and geographic restrictions. We assigned levels of collecting and identified primary acquisition sources. We settled disputes between the general collection and the archival collection. This report on our experiences and results could be of benefit to others who are planning or should plan to write such a policy.

## Latin America: A Ghost of A Chance
### Danilo H. Figueredo
### New York Public Library

I will explore the problems with Latin American cartography and the problems with the acquisition of Latin American maps, both from a historical perspective and a practical perspective. Beginning with the manipulations of French engineers mapping out the area where the Panama canal was to be built to Argentina's claim on Falkland/Malvinas, based on a chart and documents identifying the area as Spanish, I will draw parallels with political developments and even literary events that clearly illustrate that the manipulation of truth in Latin America is nothing new and is reflected on every aspect of literary, cultural, and political life. This manipulation makes publishing and the distribution of published material a dangerous and elusive game. For this reason, Latin American book dealers do not purchase maps and libraries have to depend on American dealers who travel south for the acquisition of maps.

## History of Aeronautical Cartography With Emphasis on the National Ocean Service Products
### Richard J. Comisky, III
### National Ocean Service

Aeronautical cartography began at the National Ocean Service (NOS) in 1926 when President Coolidge signed the Air Commerce Act into law. This Act gave the Secretary of Commerce responsibility for preparing aeronautical charts for commercial and private pilots. Actual compilation was delegated to the Coast and Geodetic Survey's (now NOS) Airways Mapping Section.

Since 1927 when the first "strip maps" were made available, the NOS has compiled and published many different series of aeronautical charts for the flying public. Sectional Aeronautical, World Aeronautical and Enroute Charts are some of the more popular series that are still being produced today. We will take a historical look at several aeronautical chart series to see where they have been and where they are going.

## Paper Session: Systematic Cartography (Greenbriar)
### 8:30–10:15 a.m., Friday, October 30
### Chair:

## The Discrimination of Distortion Among Individual Cognitive Maps
### Robert Lloyd
### University of South Carolina

Errors in cognitive maps may result from encoding, storage, and decoding processes. In addition to mistakes in cognitive maps caused by false information, systematic distortions occur

that are related to specific cognitive processes used by individuals. This paper focuses on two such processes. First, a comparison of individual cognitive maps is made between two groups of subjects who acquired their cognitive maps in different ways. One group coded the locations of familiar urban landmarks by navigating through a city over a long period of time. The other group coded the locations of the landmarks only from a cartographic map in a few minutes. Second, the locations of the landmarks were estimated by the subjects using three different reference points within the city. Comparison of individual cognitive maps based on the three reference points indicate whether or not internal cognitive maps produce consistent location estimates when differenct reference points are used.

The adjustments in scale and rotation and translation along the x and y axes needed to fit the estimated locations to the actual locations, using Euclidean regression, were recorded for each map as well as a distortion index. Discriminant analyses based on these error measurements indicated significant differences related to both the coding processes and the reference points used by the subjects.

### Region-Building and Cartographic Generalization: Mapping Roll-Call Votes in the U.S. House of Representatives As An Applied Example
Ruth Anderson Rowles
University of Kentucky

This paper discusses the need to develop techniques of cartographic generalization which may be applied to building regions with quantitative data. This is discussed in the context of analyzing the geographic patterns of roll-call votes in the U.S. House of Representatives. A map of a vote or series of votes can be used to describe, illustrate, and generate hypotheses about the vote at hand, and this has been done by Roach (1925), Paullin and Wright (1932), Turner (1935), Smith and Hart (1955), and Martis (1976). However, most roll-call vote studies that have explicitly incorporated any geography in an analytical framework have done so through the use of regions and have not illustrated them with maps. Out of 20 studies examined, 17 different regional schemes have been used. Obviously, there is no accepted definition of an appropriate region for a particular issue or vote at a particular time. *The Historical Atlas of U.S. Congressional Districts: 1789-1983* (Martis, 1982) is a research tool specifically designed for analyzing the geographic patterns of roll-call votes. It offers an opportunity to build political regions from contiguous districts, rather than states, and to do so directly from the roll-call data. In addition without generalization maps produced from the Martis' *Atlas* would be too large (13x17 ") and too complex (435 districts) for most scholarly publications. In the process of delineating regions, the cartographer's goal is to group adjacent unit areas while retaining some of the essential characteristics of the initial quantitative data. However, most classification procedures have focussed on grouping the quantitative data, ignoring the geographic unit areas. Cartographers and geographers need to discuss questions such as: How should regions be defined? How should regions be built? Should visual analysis be relied upon to delineate regions or empirical procedures be more fully developed?

### An Evaluation of Three Approaches to the Generation of Digital Elevation Models from Contour Data
D.J. Dudycha and J.D.E. Geddes
University of Waterloo

Existing topographic maps are a major source of data for the development of digital elevation models. The easiest way of encoding elevation data is to digitize contour lines but the data must

then be converted into a triangulated irregular network (TIN) or raster format digital elevation model (DEM) for most display and analysis purposes.

This paper evaluates three approaches to the generation of raster format digital elevation models from contour data. The methods involve estimation of grid point elevations based on: (a) distance-weighted interpolation from neighbouring points; (b) triangulation of sample points; and (c) detection of intersections between contours and grid lines. Algorithms for each approach are described and operational problems are discussed. A methodology for evaluating the three approaches which considers both the accuracy and efficiency of the techniques is outlined and empirical results derived from three test data sets representing different types of terrain are presented. The paper concludes with recommendations regarding preferred interpolation techniques and minimal data requirements for the generation of high fidelity raster DEMs.

### Data Structures for Quadtree Addressed Geographic Entities on a Spatial Relational Database
Gregory A. Elmes
West Virginia University

The performance of a geographic information system depends on the structure of geographic and cartographic data in a database management system and the formulation of search mechanisms to retrieve spatial entities and their attributes. Several types of data structure have been proposed for efficient organization of GIS databases but, until recently, relational database technology has not been used for topological information handling. Previous applications have separated locational from non-locational data. Only the non-locational data have been handled in a relational database. Relational databases offer powerful and flexible means to handle large collectons of data and a full range of geographic or cartographic entitites. Current spatial relational structures fall on a continuum between the full-normalized approach (van Roessel, 1984, 1986, 1987) and the open-ended approach using a single entity table (Waugh, 1987). The GEOVIEW system depends on the flexibiltiy of the relational structure for its power rather than on the formalism of Codd's normal forms. GEOVIEW permits points, lines, polygons, cells, blocks and tesselations to be stored in the same base tables. This paper reports the formulation of two methods of block encoding, a recursive sub-division and bit-interleaved addressing, for three illustrative datasets. The data structure is evaluated as a candidate for graphical output using GKS. SQL query language macros are implemented for retrieval of selected entities for input to graphics or spatial modeling applications. A preliminary assessment of performance characteristics is presented.

**Paper Session: Atlas Production (Greenbriar)**
**1:30–3:15 p.m., Friday, October 30**
**Chair: Ellen White, Michigan State University**

### An Analysis of Design: The Atlas of Georgia
Thomas W. Hodler
University of Georgia

A heirarchy exists of design decisions which must be considered in the creation of a state atlas. This heirarchy includes first pre-production decisions which relate to the overall "look" or appearance of the book. Such decisions include jacket design, paper stock, cover material and binding procedures. Also included are decisions pertaining to page size and page grid, printing

procedures, production specifications, style and size of type, and book content. All pre-production design affects the aesthetics and thus the attractiveness of the final product.

Second order design decisions pertain to the form in which individual data are to be presented. The form and complexity of the graphic, size/scale, legend, title and text, and color are all a part of decisions made while in production. The design process is guided by many cartographic conventions but made difficult by restrictions of page dimensions and production schedules. The design or layout of an individual page and the interaction of complimentary (facing) pages are included in this part of atlas design.

The manner in which an atlas is designed, both pre-production and in-production decisions, will affect the degree of both communication and information transfer. In order to evaluate the effectiveness of select design decisions made in the creation of *The Atlas of Georgia*, a questionaire was distributed randomnly to purchasers in which they were asked to respond to map use questions which allow for evaluation of specific page, map and legend design. An analysis of the results of this survey will be presented addressing these design decisions and their communication effectiveness.

### Printing and Binding Costs for State Atlases
Dale Steele

Although printing and binding are the last stages in an atlas' creation, the cartographer must consider them in the earliest stages. Design decisions he makes early in the atlas project, such as page size and orientation, will greatly affect the atlas' printing and binding costs. If he ignores the effect these decisions have, he may design and draft a work he can't afford to print. While only an experienced printing purchaser can provide specific guidelines and estimates to an atlas project director, the experiences of other atlas projects can also provide some useful background information. I have cost data for the printing and binding of 5 general multi-color state atlases. I have examined them and taken them to others experienced in the graphic arts to get estimated price breakdowns. I would like to share this information to show how different factors affect atlas printing and binding costs.

### Production Guidelines for Producing Comparitive Urban Atlases
James F. Fryman
University of Northern Iowa

Over the past three years an advanced cartography class at the University of Northern Iowa has designed, produced and marketed a community atlas of urban areas for the following states; Iowa, North Carolina and Florida. The idea behind the atlases was to have a team project that would expose students to all facets of a production/reproduction project and in addition result in a product that would have value to governmental and business concerns as well as the general public. The atlases contained on average 20 maps of population, economic, housing characteristics, voting patterns and crime patterns for each of the 10 to 12 communities. In addition 32 graphs and charts compared average measures between communities. This presentation will outline the necessary steps to produce a community atlas for any city(s) having statistical data available at the census tract, crime zone and precinct level. Graphic examples will be presented of each production step and suggested topics for mapping and problem areas will be highlighted.

### The Development of An Atlas Project
Ute J. Dymon
University of Massachusetts

Atlases are an important part of spatial data communication. They provide map users with a quick overview of the area studied. They also are costly and difficult to produce. This paper addresses the special consideration before embarking on such a project. It looks at the conceptualization of the project, the project specifications, resource availability and considerations in writing the final project proposal.

**Paper Session: General Cartography (Emory)**
**1:30–3:15 p.m., Friday, October 30**
**Chair:**

### What Happens When We Get Lost?
Jeremy Crampton
Pennsylvania State University

Although a moderate amount of work has investigated how humans navigate, either on their own (e.g. Marks, 1987, Cox, 1987) or with automobile aids (e.g., Petchenik, 1987), less work has investigated what happens when we get lost. Being lost however, is not just the opposite of knowing one's position. I analyze this distinction in several ways. First, a simple mental model of wayfinding is used to identify several categories of "lostness" of increasing severity. Second, there are concomitant human behaviors attached to each condition of being lost. People act differently according to the severity of their lostness. When these behaviors are understood in light of the appropriate condition of lostness, navigation aids can be developed to rectify and (crucially) prevent being lost. Parallels with vehicle navigation systems such as ETAK are discussed.

### Promotion, Politics, and Provincialism:
### Map Marketing and Sponsorship in a Small City Environment
Keith W. Rice
University of Wisconsin-Stevens Point

Geographers have always expended considerable effort in demonstrating their expertise and abilities in serving the needs of both government and the private sector. A natural outreach of many university geography departments is in producing map products that may be disseminated throughout the local community or region. Large cartographic production laboratories have successfully accomplished this adjective for decades, but lately smaller universities with modern cost-effective mapping facilities have also been able to produce high-quality map products.

The University of Wisconsin-Stevens Point is one such laboratory. Over the last year it undertook several large-scale mapping projects in order to promote itself and the university within the surrounding community. However, like many secondary universities UW-Stevens Point is located in a small city which presented unique problems in the marketing and sponsorship of its map products. The peak and pitfall experiences of the UWSP Cartography Laboratory in the

selling of its initial maps resulted in the development of a highly successful three-fold tactical marketing strategy.

First, in order to *promote* the map product time and effort must be given in carefully educating potential patrons about maps. Usually time spent displaying laboratory map examples while talking about their usefulness will greatly diminish cartographic ignorance, while avoiding the cardinal sin of peer lecturing. Secondly, the successful sponsorship of a map is also highly dependent on cultivating both *economic and political* contacts in your market region. Setting up a related network of interested buyers is essential to not only the initial map sponsorship, but also to its dissemination. Finally, the *provincial* attitude of many small city officials will tend to usurp your marketing endeavors. This can be negated by having your initial patrons, instead of yourself, persuade their community peers to aid in the sponsorship of your map.

### Microcomputers and Cartographic Education
Dennis Fitzsimons
Southwest Texas State University

The availability and variety of microcomputers and mapping software has created new dilemmas for cartography instructors. Is now the time to retire manual-drafting techniques in favor of a new and better technology, or are there elements from traditional cartography courses that should be retained to provide students with essential skills? How does one teach principles of cartographic design; e.g., visual hierarchy, balance, contrast, typography and lettering placement, selection of appropriate map elements, scale, projection, and symbolization, to students using automated mapping techniques? In traditional cartography courses students needed to first become proficient with manual-drawing skills, data processing, and map design principles before they could make acceptable maps. Today, with some computer-assisted mapping systems, the learning procedure can be practically reversed; allowing a novice to make maps (or at least map-like displays) without acquiring manual skills, an understanding of data processing, or principles of map design. Although the lack of needed manual skills may be viewed as a blessing for many, the importance of the latter two categories remains. To make aesthetic choices about the appropriateness of a map, without knowledge of data processing techniques or design considerations, frequently leads to problems with the effectiveness of data communication.

### Cartography at the National Geographic Society–
### The Making of America West Indies Map Supplement

### La cartographia de la National Geographic Society–
### El mapa del Caribe en la serie cartografica "The Making of America"
Juan Jose Valdes
National Geographic Society

En 1982 la Division de Cartografia de la National Geographic Society publico el primer maps de la serie catografica "The Making of America". Este proyecto culminara en 1988, fecha que marca el primer centenario de la Society, y consistira de mapas de doble cara que cubren 17 regiones de los Estados Unidos incluyendo partes de Canada y Mexico, con un mapa separado del Caribe.

Esta serie de mapas presenta el desarrollo historico y las caracteristicas especificas de cada region con un alto contenido de creatividad, investigacion y sintesis. Esta presentacion ex-

amina la accion intermedia entre la cartografia, el dibujo y el texto en la creacion del mapa del Caribe, que sera publicado en noviembre de 1987.

In 1982 the National Geographic Society's Cartographic Division embarked on its pioneering Historical Geography supplement series, "The Making of America". Scheduled for completion in 1988—the Society's centennial year—the series consists of 17 double-sided regional maps of the United States, some overlapping with parts of Canada and Mexico, and seperate coverage of the West Indies. The maps provide a fresh look at the historical development and special characteristics of each region. This presentation examines the interaction of cartography, artwork and text in the creation of the West Indies supplement, which will be published in the November 1987 issue of the National Geographic.

**Paper Session: Cartographic Systems (Emory)**
**9:00–11:00 a.m., Saturday, October 31**
**Chair:**

### USGS Composite Theme Grid File and Norbeck's Allometric Growth Law
Peter S. Pate
Pennsylvania State University

The USGS Composite Theme Grid (CTG) file corresponding to the Harrisburg 1:250,000 quadrangle is used to examine three areas of interest: 1) Verification of Nordbeck's allometric growth law is performed, 2) selected land use and socioeconomic patterns are examined in Harrisburg, Pa., and 3) errors inherent in the file.

Nordbeck's allometric growth law is investigated using an American example. While the law holds in general form, the coefficients from Nordbeck's theoretical work do not pertain in a North American context. Patterns of selected land use and socioeconomic variables are displayed and are consistent with geographic theory. A comparison of area computed from the CTG file and area measured from maps is presented. Relatively small differences exist.

### A Totally Automated Map Production System for Census Maps
Connie Beard
U.S. Bureau of the Census

The Census Bureau is developing a nationwide map production system from TIGER (Topologically Integrated Geographic Encoding and Referencing System). The map production process is totally automated. No manual edits or interventions of any kind are performed. All cartographic decisions are determined automatically. Preliminary tasks such as scaling, insetting, sheet size determination, and map sheet identification are performed by a customized expert system called the preprocessing module. The first map generated by this system is a new Census map product, the County Block Map

This paper examines the preprocessing module that generates the County Block map. It describes the etiology of the expert system design, the current design specifications, and an evaluation of the results of the system as it applies to the County Block map production. Although still evolving, the results from the first applications of the automated map production system are promising. As more and more maps are produced and evaluated, the expert system will be refined and enhanced.

## Implementation and Ongoing Operation of the
## Mississippi Automated Resource Information System (MARIS)
Robert H. Smith, Jr.
Mississippi Research and Development Center

The Mississippi Automated Resource Information System (MARIS) was formed in 1982, and became a legislated entity in state government in 1986, for the purpose of coordinating and centralizing the collection, storage, and analyses of natural and cultural resource data for the state of Mississippi through interagency cooperation, planning, and management. Geographic information system (GIS) technology is the focal resource means of achieving that purpose.

MARIS consists of a Systems Central staff that conducts the day-to-day technical and administrative operations of the GIS system. Executive and Policy committees initiate policy and provide a vehicle for the coordinated participation in system activities of more than 20 state agencies. A task force committee composed of technical personnel from each cooperating state agency investigates and/or addresses specific applications or concerns about natural and cultural resources that can be met with GIS technology.

The past five years were focused on the organizational growth and awareness of the MARIS community to create a unified, coordinated, and cooperative network of personnel within state government about cultural and natural resource information management. In this time frame a basic GIS system has been established with hardware, software, and technical expertise which is available to the MARIS community. A statewide data base containing base data on more than 50 variables has been digitized and is stored on-line in a gridded format using the UTM coordinate system.

Current and future operations of MARIS are to:
1. Intensify its efforts to develop and promote interagency resource planning and program coordination with the MARIS community.
2. Continue providing, updating, and enhancing a variety of GIS technical services to state government.
3. Provide educational services about GIS technology to state agencies.

## Mapbase–NOAA/Aeronautical Charting's Database of USGS Maps
Christine McNerney
National Oceanic and Atmospheric Administration

The Aeronautical Chart Branch of the National Oceanic and Atmospheric Administration (ACB) makes use of U.S. Geological Survey (USGS) topographic quadrangles in a variety of compilation processes. Determining necessary quadrangles using paper indexes supplied by the USGS is a time-consuming task, often performed with non-current information. The Aeronautical Chart Automation Project acquired a magnetic tape of map data from the USGS and determined that the information could be incorporated into the existing database system at ACB. Through a series of programs, the nonessential map data was discarded, map corners computed, and the data entered into the database. ACB cartographers can retrieve the data for quad coverage of geographic areas in a matter of minutes formatted as reports, listings to order quads, and as graphic plots. A new routine was added to the retrieval system to determine a quadrangle from a user-entered geographic position. The use of USGS data has had a significant effect in reducing staff hours and costs at ACB.

**Workshop: Computers in University Cartographic Laboratories (Greenbriar)**
**9:00–11:00 a.m., Saturday, October 31**
**Organizer: Donna Schenstrom, University of Wisconsin-Milwaukee**

An informal poll of NACIS university cartographers has noted that most do not have access to computer mapping facilities. The goal of this workshop is to share information to enable cartographic laboratories to obtain computer mapping capabilities.

Participants with computer mapping facilities are encouraged to bring hand-outs listing the type, brands, and cost of their hardware and software, examples of output, start up time, and pros and cons of their specific systems.

Participants:

Hubertus Bloemer
Ohio University

Onno Brouwer
University of Wisconsin

Frank Drago
Georgia State

James Ingram
University of Georgia

Mike Lipsey
Michigan State University

Chris Mueller-Wille
Texas A&M

Craig Remington
University of Alabama

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