PROGRAM and ABSTRACTS

NACIS VIII

Cartographic Applications: Expanding Frontiers

North American Cartographic Information Society
Eighth Annual Meeting

DENVER - Radisson Hotel
October 12-15, 1988

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NACIS VIII

Cartographic Applications: Expanding Frontiers
October 12–15, 1988
Denver, Colorado

Radisson Hotel Denver
Denver, Colorado
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Conference Participants:

Welcome to NACIS VIII—the eighth annual meeting of the North American Cartographic Information Society. This year's meeting, under the heading CARTOGRAPHIC APPLICATIONS: EXPANDING FRONTIERS, investigates many timely topics. When NACIS was established eight years ago, cartography was still largely a conventional science. Few universities and government agencies and even fewer private companies then used computers to assist in formulating grids and plotting shorelines. With the recent proliferation of relatively inexpensive hardware and mapping software, all this has changed. Today cartographers are restricted only by their budgets. It is appropriate, therefore, that this year's conference should explore how the map information community is using current cartographic technologies. Presentations from Canada, Argentina, Costa Rica and Mexico will describe mapping trends in those countries. In keeping with the Society's mission of improving communication, coordination, and cooperation among cartographic professionals, conference participants will have an opportunity to tour several of "The Mile High City's" leading government and private cartographic operations.

While in Denver I hope you take the time to visit some of the major attractions within walking distance of the Conference Center. I would also like to invite all—non-members included—to the post-conference social gathering in Central City in the Front Range of the Rocky Mountains.

My thanks to all the members of the 1988 Conference Committee and the Executive Board, who helped plan and organize NACIS VIII. I an grateful to the many speakers in this year's program for their enthusiasm and cooperation. And I thank all of you for participating in what promises to be a most interesting conference.

Juan José Valdés
NACIS VIII Conference Director

Radisson Hotel Denver
Denver, Colorado
12-15 de Octubre, 1988

Participantes a la Conferencia:

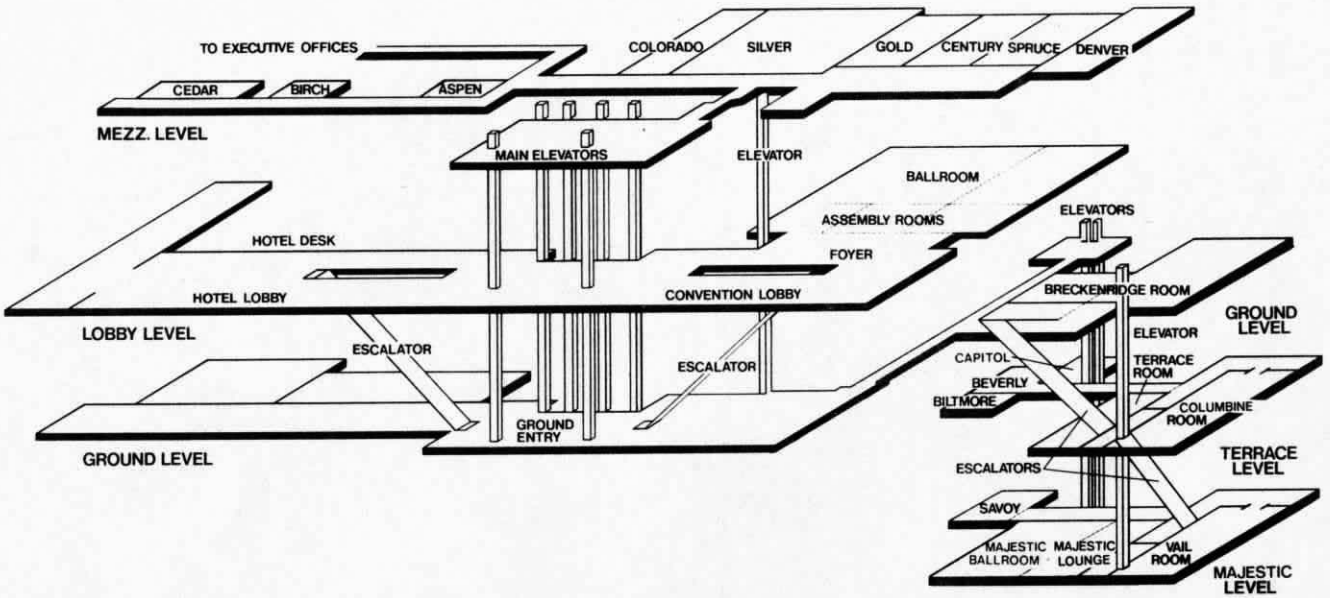
Bienvenidos a NACIS VIII—la octava reunión anual de la North American Cartographic Information Society. Este año la conferencia estará bajo el signo de APLICACIONES CARTOGRAFICAS: EXPANSIONES DE FRONTERAS, investigando diferentes topicos actuales. Cuando la NACIS fue fundada ocho años atras, cartógrafia era una larga ciencia convencional. Algunas universidades, agencias gubernamentales y algunas compañias privadas utilizaban las computadoras para producir projécciones y lineas costeras. Con la reciente creación de nuevas conputadoras y programas cartográficos, todo esto ha producido un gran cambio. Hoy en dia los cartografos están restringidos solamente por sus recursos monetarios. Por esto es apropiado que este año la conferencia esplorará como la comunidad cartógrafica esta usando la tecnologia contemporarea para producir los mapas. Se presentarán modas cartográficas del Canada, Argentina, Costa Rica y Mexico, y se describirán como estos paises producén los mapas. Manteniendo la mision de la sociedad de mejorar la comunicación, coordinación y cooperación entre los cartógrafos profesionales, los participantes a la conferencia tendrán la oportunidad de ver presentaciones cartográficas del gobierno y compañias privadas en "The Mile High City."

Durante su estadia en Denver, yo espero que ustedes tengan tiempo de visitar algunas de las mayores atracciones que están cerca del centro de conferencias. Me gustaria invitar a todos a la reunión social en Central City en el Front Range de los Rocky Mountains.

Mi profundo agradecimiento a todos los miembros del comité de la conferencia y a los ejecutivos del board de 1988 quienes ayudaron a organizar el plan para NACIS VIII. Yo estoy muy agradecido a todos los oradores que actuaron en el programa de este año, por su entusiasmo y cooperación. Y gracias a todos ustedes por participar en lo que promete ser una interesante conferencia.

Juan José Valdés
Director de la Conferencia,
NACIS VIII

CONVENTION CENTER COMPLEX



CONFERENCE NOTES

Registration:

The Registration Desk is located in the Breckenridge Foyer on the ground floor of the Radisson Hotel Denver's Conference Center Complex. Registration hours are:

Wednesday, October 12	1:00 p.m.–7:30 p.m.
Thursday, October 13	8:00 a.m.–12:00 p.m.
Friday, October 14	8:00 a.m.–4:00 p.m.
Saturday, October 15	8:00 a.m.–11:15 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 field trips
Annual Banquet
Annual Luncheon
Refreshment Breaks

Individuals are responsible for their own expensives for cash bars at receptions and post-conference social.

Field Trips:

Registration for field trips will be handled at the Registration Desk. Four field trips have been planned for NACIS VIII. Please check at the Registration Desk for descriptions of the trips, sign-up sheets, and departure times and locations. The field trips will have size limitations so please check at the Registration Desk to see if you made the cut for the trip you have 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 Breckenridge Room on the ground floor of the Radisson's Convention Center. Exhibits will be open:

Thursday, October 13	9:00 a.m.–12:00 p.m.
Friday, October 14	9:00 a.m.–3:00 p.m.

NACIS VIII

CARTOGRAPHIC APPLICATIONS: EXPANDING FRONTIERS

WEDNESDAY, OCTOBER 12, 1988

1:00–7:30 p.m. REGISTRATION - Breckenridge Foyer

1:00–7:00 p.m. EXHIBITS SETUP - Breckenridge

3:00–7:00 p.m. POSTER SESSIONS SETUP - Breckenridge

1:00–3:00 p.m. NACIS COMMITTEE MEETINGS
Check bulletin board for listings.

3:00–5:00 p.m. NACIS BOARD MEETING - Terrace

7:00–9:00 p.m. OPENING SESSION - Vail

WELCOME
Billie C. Swenson, Local Arrangements Director
Director, Jefferson County Mapping Department, Golden, CO.

NACIS VIII - CARTOGRAPHIC APPLICATIONS: EXPANDING FRONTIERS
Juan José Valdés, Conference and Program Director
National Geographic Society

PRESIDENT'S ADDRESS
Johnnie D. Sutherland, University of Georgia-Athens

KEYNOTE ADDRESS
Five Faces of the West
Dr. Allen B. Breck

9:00–11:00 p.m. NACIS RECEPTION and CASH BAR - Breckenridge and Breckenridge Foyer

9:00–11:00 p.m. POSTER SESSION - Breckenridge

Current Cartographic Developments
Organizer: Ellen R. White, Michigan State University-East Lansing

Participants:

Gregory Chu
University of Minnesota

Will Fontenez
University of Tennessee

Chase Langford
University of California-Los Angeles

Geoffrey A. Lester
University of Alberta

Mark Mattson
Temple University

Christopher Meuller-Wille
Texas A & M

Dennis M. Richter
University of Wisconsin

Hans Stolle
Western Michigan University

Charles T. Traylor
Memphis State University

Carolyn Weiss
University of Minnesota

Fred Weston
Oregon State University

Ellen R. White
Michigan State University

THURSDAY, October 13, 1988

8:00–1:00 p.m. REGISTRATION - Breckenridge Foyer

9:00–12:00 p.m. EXHIBITS OPEN - Breckenridge

8:30–10:00 a.m. PAPER SESSION: COMPUTER APPLICATIONS IN CARTOGRAPHY - Vail
Chair: P. Blake McCully, Systems Analyst, Department of Geography and Regional Planning, Indiana University of Pennsylvania, Indiana, Pennsylvania

Computer Assisted Cartography - A Position Paper
Eckart F. Leistikow, Section Manager, Cartography, Cartographic Information Division, Bureau of Strategic Planning, Dept. of Transportation, Commonwealth of Pennsylvania, Harrisburg, Pennsylvania

The Librarian's Dilemma: The Map Librarian's Access to Machine Readable Information
Patrick McGalmery, Map Librarian, Homer Babbidge Library, University of Connecticut-Storrs

"CARTO-GRAPHICS" Thematic Map Production at the World Bank
Les Barker, Cartographer/Computer Graphic Specialist, The World Bank, Washington, D.C.

8:30–10:00 a.m. PAPER SESSION: ATLAS AND MAP PRODUCTION - Columbine
Chair: Patricia P. Gilmartin, Associate Professor, Department of Geography, University of South Carolina–Columbia

The Creation of a City Atlas Series - from Atlas of Charlotte-Mecklenburg, 1st and 2nd Edition, to Charlotte-Patterns and Trends of a Dynamic City
Jeff L. Simpson, Lecturer, Department of Geography and Earth Sciences, University of North Carolina at Charlotte

Intromap: An Interactive Tutorial for Basic Map Production
Dr. David Woodward, Department of Geography, University of Wisconsin–Madison
David DiBiase and John Krygier, Graduate Students, Department of Geography, University of Wisconsin–Madison

The Making of a Thematic Atlas - Atlas of Southeast Asia
Dr. Julius Pauer, Department of Geography, University of Kentucky–Lexington

10:00–10:30 a.m. REFRESHMENT BREAK IN EXHIBITS - Breckenridge

10:30–12:00 p.m. PAPER SESSION: GEOGRAPHIC INFORMATION SYSTEMS -Vail
Chair: H. Kit Fuller, Geologic Inquiries Group, USGS Library, Reston, Virginia

Geographic Information Systems Trends
Darrell McGregor, Technical Applications Specialist, GeoVision Systems Inc., Aurora, Colorado

The Geographic Names Information Retreival Program
Robert P. Sechrist, Department of Geography and Regional Planning, Indiana University of Pennsylvania, Indiana, Pennsylvania

Open File Report Map Index and Bibliographic Reference System Using PC-File III
Ron Hess, Geologic Information Specialist, Nevada Bureau of Mines and Geology, University of Nevado–Reno

10:30–12:00 p.m. PAPER SESSION: THEMATIC CARTOGRAPHY - Columbine
Chair: Ruth Anderson Rowles, Graduate Student, Department of Geography, University of Kentucky–Lexington

Error in Global Cognitive Maps
Patricia P. Gilmartin, Associate Professor, Department of Geography, University of South Carolina–Columbia
Robert E. Lloyd, Professor, Department of Geography, University of South Carolina–Columbia

Landmark Representation on Street Maps
Ann Kielkopf Deakin, Graduate Student, Department of Geography, Penn State University

Maximization of the Receptivity of the Cartographic Message
Josefina Ostuni, Profesor, Instituto de Geografía, Facultad de Filosofía y Letras, Universidad Nacional de Cuyo, Mendoza, Argentina

12:00–1:00 p.m. Lunch Break

1:00–5:00 p.m. TOURS

TOUR A: Jeppesen Sanderson Inc.
TOUR B: Pierson Graphics and Kistler Graphics
TOUR C: USGS/National Geophysical Data Center and the National Park Service
TOUR D: Denver Regional Census Center

6:30–7:15 p.m. RECEPTION AND CASH BAR – Majestic Lounge

7:15–9:00 p.m. ANNUAL BANQUET – Majestic Ballroom
Banquet Address: *The Image of the Spherical Earth*
Dr. David Woodward, Department of Geography, University of Wisconsin–Madison

9:00 p.m. RECEPTION AND CASH BAR – Majestic Ballroom

FRIDAY, October 14, 1988

8:00–4:00 p.m. REGISTRATION – Breckenridge Foyer

9:00–3:00 p.m. EXHIBITS OPEN – Breckenridge

8:30–10:00 a.m. PAPER SESSION: MAPPING SYSTEMS – Columbine

Chair: David DiBaise, Graduate Student, Department of Geography, University of Wisconsin–Madison

Georgia's Approach to Developing a Statewide GIS
Arden Brey, Senior Consultant, Georgia Deparment of Community Affairs, State Cartographic Information Center–Atlanta

Visibility Modeling Using Triangular Networks
Douglas J. Dudycha, Assistant Professor, Department of Geography, University of Waterloo, Ontario, Canada

Automated Filtering of Redundant Data Points in a Triangulated Irregular Network Digital Elevation Model
John D. E. Geddes, Masters Candidate, Department of Geography, University of Waterloo, Ontario, Canada

8:30–10:00 a.m. PAPER SESSION: CARTO-TECHNOLOGIES - Vail
Chair: Les Barker, Cartographer/General Services Department, The World Bank, Washington, D.C.

ATLAS DRAW
P. Blake McCully, Systems Analyst, Department of Geography and Regional Planning, Indiana University of Pennsylvania, Indiana, Pennsylvania

The Changing Cartography Laboratory Traditional Mapping to Computer Graphics
Dr. Dennis M. Richter, AICP, Professor of Geography, Department of Geography, University of Wisconsin-Whitewater

An Advance Hardware and Software Solution to Geoprocessing
Darrell McGregor, Technical Applications Specialist, GeoVision Systems Inc., Aurora, Colorado

10:00–10:30 a.m. REFRESHMENT BREAK - Breckenridge Foyer

10:30–12:00 p.m. SPECIAL PAPER SESSION: MANAGING MAP COLLECTIONS - Vail
Session Organizer: Johnnie D. Sutherland, University of Georgia Libraries-Athens

12:00–1:30 p.m. LUNCH

1:30–3:00 p.m. PAPER SESSION: CANADIAN AND LATIN AMERICAN CARTOGRAPHY - Vail
Chair: J. Hull McLean, Geographic Specialist, Department of State, Washington, D.C.

Canadian Cartography and the Cartographic and Architectural Division, National Archives of Canada
Louis Cardinal, Chief, Collections Section, Cartographic and Architectural Division, National Archives of Canada

A Brief on the 5th Edition of the National Atlas of Canada
Dan MacKay, Senior Geographer, Geological Research, Geographical Services Division, Canada Centre for Mapping, EMR Canada

La Cartografía en Costa Rica (Breve Reseña Historica) Cartography in Costa Rica: A Brief Historical Review
Ing. Rodrigo Vega Herrera, Presidente, Colegio de Ingenieros Topógrafos, San José, Costa Rica

1:30–3:00 p.m. PAPER SESSION: REMOTE SENSING – Columbine
Chair: Jeffrey C. Patton, Associate Professor of Geography, University of North Carolina at Greensboro

Worldwide Mapping Using Satellite Imagery: The Utility of Spot Imagery for Cartographic Application
Seth I. Gutman, Carterra Incorporated, Golden, Colorado

Reconaissance Survey of Land Resources, Los Tuxtlas, Mexico: Holistic Integration Landscape Approach
Maria Concepcion Garcia, Universidad Nacional Autonoma de Mexico, Distrito Federal, Mexico

3:00–3:15 p.m. REFRESHMENT BREAK – Breckenridge Foyer

3:15–5:00 p.m. ANNUAL BUSINESS MEETING – Columbine

5:00 p.m.– OPEN

SATURDAY, October 15, 1988

8:00–11:15 a.m. REGISTRATION – Breckenridge Foyer

9:00–11:15 a.m. PAPER SESSION: GENERAL CARTOGRAPHY – Vail
Chair: Patrick H. McHaffie, Kentucky Geological Survey

The Role of the National Ocean Service (NOS) in the Cartographic Marketplace
Martha Soneira, Aeronautical Charting Division, National Ocean Service, National Oceanic and Atmospheric Administration, Rockville, Maryland

Map Supplement Design, National Geographic Society
Robert E. Pratt, Senior Map Designer, Cartographic Division, National Geographic Society

Technical and Stylistic Changes in Type on National Geographic Maps, 1889–1988
Barbara Mullin, Graduate Student, Department of Geology and Geography, Hunter College, New York

9:00–11:15 a.m. NAVIGATIONAL CHARTING SYSTEMS – Columbine
Chair: Diana Rivera, Michigan State University-East Lansing

Loran C: General Aviation's Navigation System for the Future
Ronald M. Bolton, Chief of the Aeronautical Chart Branch of the Aeronautical Charting Division at the National Ocean Service (NOS), Rockville, Maryland

Microwave Landing Systems: The Future Approaches
Russell Hoover, Cartographer, National Ocean Service (NOS), Rockville, Maryland
Claudet Dellon, Computer Specialist, National Ocean Service (NOS), Rockville, Maryland
Ronald M. Bolton, Chief of the Aeronautical Chart Branch of the Aeornautical Charting Division at the National Ocean Service (NOS), Rockville, Maryland

Quality Control Procedures for Digital Data Utilized for Navigation in the National Airspace System
Claudet Dellon, Computer Specialist, National Ocean Service (NOS), Rockville, Maryland
Ronald M. Bolton, Chief of the Aeronautical Chart Branch of the Aeronautical Charting Division of the National Ocean Service (NOS), Rockville, Maryland
Robert Niedermair, Computer Specialist, National Ocean Service (NOS), Rockville, Maryland

11:15–11:30 a.m. BREAK

11:30–1:00 p.m. LUNCHEON - Majestic Ballroom
LUNCHEON ADDRESS: Inquiring with Maps
Professor A. David Hill, Department of Geography, University of Colorado at Boulder, Coordinator, Colorado Geographic Alliance, and Director, Center for Geographic Education

1:00 p.m. POST-CONFERENCE SOCIAL AT CENTRAL CITY AND THE LAZY H RANCH

ABSTRACTS

Thursday, October 13, 1988
8:30 a.m.–10:00 a.m.
Paper Session: Computer Applications in Cartography - Vail

Chair: P. Blake McCully, Systems Analyst, Department of Geography and Regional Planning, Indiana University of Pennyslvania, Indiana, Pennsylvania

Computer Assisted Cartography - A Position Paper
Eckart F. Leistikow
Section Manager, Cartography, Cartographic Information Division, Bureau of Strategic Planning, Department of Transportation, Commonwealth of Pennsylvania, Harrisburg, PA

The purpose of this presentation is to identify the components that define an automated cartographic operation, to introduce the concept of computer assisted cartography and to describe the relationships between the existing manual operations and automated ones. It further is designed to discuss the cartographer's role in facilitating cartographic automation.

The Librarian's Dilemma: The Map Librarian's Access to Machine Readable Information
Patrick McGlamery
Map Librarian, Homer Babbidge Library, University of Connecticut-Storrs

The librarian's role of access to information is expanding to include non-book materials in the form of machine readable information. As we become comfortable with computers as bibliographic access tools we will be expected to access information in machine readable form. Advances in the technology of mass storage and increased availability of appropriate work stations will allow us to provide access to primary information heretofore available only to select users. The availability, for example, of census information on CD-ROM will change how we are asked to provide information.

The Map Library at the University of Connecticut was awarded an LSCA grant to provide mapping for demographic information. "Map for the Future: Computer-assisted Cartography for the Community" provided this librarian with an opportunity to investigate and realign the role of the librarian. The outcome of the grant was a workstation, software and data, and most importantly a mainframe-based system, PTOLEMY using SAS/Graph and SAS/AF programming that allows users to create maps of their spatial analyses. As it is a mainframe-based program, it can deal with large files, be accessed from remote sites and be taught to an extended user group not only at the University of Connecticut in Storrs but throughout the state.

Patrick McGlamery is the Map Librarian at the Homer Babbidge Library of the University of Connecticut. The Map Library is an NCIC state affiliate with the state's DEP Natural Resource Center. It is the Federal Depository System's Regional Depository for Connecticut and Rhode Island. Mr. McGlamery has been at the university for eight years after a five-year tenure at the Library of Congress Geography and Map Library. He is a co-founder of the New England Map-user's Organization (NEMO) and is currently its first president. This is his first talk at NACIS.

"Carto-graphics"
Thematic Map Production at the World Bank
Les Barker
Cartographer/Computer Graphic Specialist, The World Bank, Washington, D.C.

Microcomputer-based software packages for mapping and graphics have radically altered the production of thematic maps at the World Bank, which uses a broad array of cartographic products to support its activities in promoting social and economic progress in the developing countries.

For more than 20 years the Bank's Cartographic Section relied on a mix of scribing techniques and pen-and-ink methods to produce these maps. Then, in 1987, the Cartographic Section introduced a microcomputer-based system for mapping and graphics, changing both the technology and the interaction between cartographers and maps.

Underlying this system is the idea of teaching the cartographer to use computers—rather than teaching computer operators to make maps. The idea has promoted the rapid proliferation of microcomputer-based mapping systems at the World Bank.

Thursday, October 13, 1988
8:30 a.m.–10:00 a.m.
Paper Session: Atlas and Map Production - Columbine

Chair: Patricia P. Gilmartin, Associate Professor, Department of Geography, University of South Carolina–Columbia

The Creation of a City Atlas Series–From "Atlas of Charlotte-Mecklenburg," 1st and second edition, to "Charlotte. Patterns and Trends of a Dynamic City"
Jeff L. Simpson
Lecturer, Department of Geography and Earth Sciences, University of North Carolina at Charlotte

The paper presents a brief description of the steps taken to create interest in and to generate funding for the first Charlotte atlas that was published in 1978 and the subsequent inertia that developed to publish updated and improved editions as the city grew and prospered. The success of the atlas series is examined in terms of the dynamic leadership provided by the editors of the atlases, the importance of community and university support and the existence of a quality cartographic lab within the Department of Geography and Earth Sciences at UNCC. This is followed by a discussion of the organizational structure that was created to produce the most recent edition of the Charlotte atlases: *Charlotte. Patterns and Trends of a Dynamic City*. The production is examined from a cartographic perspective in that the cartographic facilities and the map making processes that were used to create the current atlas are presented. The paper concludes with information about the marketing and distribution of the atlases.

IntroMap: An Interactive Tutorial for Basic Map Production

David Woodward, David DiBiase, and John Krygier
Department of Geography, University of Wisconsin—Madison

This paper introduces work in progress on a series of linked Apple McIntosh HyperCard stacks in which beginning cartography students and laboratory trainees are introduced to a typical map production sequence from compilation worksheet to final proof using conventional techniques. The prototype describes the production of a simple monochrome map in a series of hierarchically arranged stages. Under each major heading—Compilation Worksheet, Production Plan, Linework, Lettering and Point Symbols, Negatives, Area Fills, Positive Masks, and Proof—the procedures are carefully subdivided and explained. Each procedure is illustrated with an image of the desired result and the consequences of students' choices of subsequent steps are also portrayed graphically. The students may also browse interactively through unfamiliar procedures in the sequence and relate their present work to previous or subsequent stages. At any time in the sequence, the students' position in a production flow chart is available at the touch of a screen button, as is a succinct glossary of all photomechanical terms and procedures and a help manual. Although the prototype has been designed for simple monochrome maps, the courseware can easily be extended to complex four-color map production for advanced courses in cartographic design introducing computer assistance at various stages. The system has been designed using the experience and methods of the University of Wisconsin Cartography Laboratory, but it can be readily modified to conform to special procedures, terminology and product brand names used by other laboratories or instructors with access to a Macintosh. The paper will demonstrate a portion of the HyperCard stack, explain some of the conceptual and technical problems of developing the HyperCard data structure, weigh the advantages and disadvantages of the HyperCard format, and report on the experiment's early reception by students and laboratory trainees.

The Making of a Thematic Atlas—"Atlas of Southeast Asia"

Dr. Julius Pauer
Department of Geography, University of Kentucky–Lexington

Why a regional atlas?
Why a university cartography lab should produce it?
Who should publish it?
Production procedures.

There is a need for regional atlases for a variety of reasons: the region's importance to other parts of the world, political and strategic considerations, historical ties, etc. The purpose of the "*Atlas of Southeast Asia*" is to provide a popular comprehensive guide to one of the world's major geographical regions.

The proposed atlas will include major topics found in standard atlases as well as maps and other materials on topics of special importance to Southeast Asia.

The UK Cart Lab has the equipment to produce professional quality maps and illustrations. The geography faculty is a natural choice to do the research. The combination of cartographer and geographer at one single department gives the best possible combination with the lowest overhead.

The publishing of an atlas, however, should be left up to a highly regarded publisher with experience, resources and professional integrity.

Production procedures should consider the project from A to Z. Such considerations are: the availability of source maps and data, high quality photographs, cartographic production, quality control, etc. Marketing considerations play a major role in producing an atlas.

The success of producing a regional atlas depends on many factors: publisher, researcher, cartographer and last but not least the printer.

Thursday, October 13,1988
10:30 a.m.-12:00 p.m.
Paper Session: Geographic Information Systems - Vail

Chair: H. Kit Fuller, Geologic Inquiries Group, U.S.G.S. Library, Reston, Virginia

Geographic Information Systems Trends
Darrell McGregor
Technical Applications Specialist, GeoVision Systems, Inc., Aurora, Colorado

As we enter the second decade of geographic information systems in the city/county and regional information systems field, important technology trends are emerging that will define the future direction of geographic information systems. No longer are departmental systems hidden in the back room, accessible only to the technocrats. Today, cooperating organizations require a visible system that is accessible to diverse users with differing applications, and a system that can corporately manage a multi-participant geographic database. To meet these requirements, six important technology trends have emerged; continuous coverage, spatial-relational database, topological data structure, distributed processing, content management and open hardware/software architecture. This paper will define and describe the six technology trends and their importance to a multi-participant, multi-application geographic information system.

The Geographic Names Information Retrieval Program
Robert P. Sechrist
Department of Geography and Regional Planning, Indiana University of Pennsylvania

The Geographic Names Information System database (GNIS) is a product of the United States Geological Survey that includes positioning information for named features found on 7.5 minute quadrangle sheets. GNIS has a wide variety of potential instructional and practical uses; however, as with most geographic databases its application is limited without graphic display capability.

The GNIS Retrieval Program provides for a graphic display of the GNIS database. The program runs on an IBM AT or compatible with harddisk and EGA graphics. The program handles queries for place names through a two level selection system. Users first select the type of feature they wish to find, stream, school, church, valley, summit, etc. Users then give a string pattern for the program to find matches in the data base. The program, upon finding a match, displays the record. Once all matches are found, the user may request to see the points mapped on the screen, and/or on paper.

The program makes the data base functional for a variety of uses. Map librarians use the program to provide an automated indexing system for the identification of the topo sheet a feature is located upon. Similarly, the program can tell the county of a feature. The program can be a valuable aid in the teaching of cultural geography because it allows for rapid generation of maps of related place names. Many other, as yet unidentified, uses exist for the program.

Open File Report Map Index and Bibliographic Reference System Using PC-File III
Ronald H. Hess
Geologic Information Specialist, Nevada Bureau of Mines and Geology, University of Nevada-Reno

The Nevada Bureau of Mines and Geology had a need to develop an indexing system for open-file reports and maps that would allow rapid retrieval of file number, map name, location, and bibliographically correct reference. In addition to this, the system hardware/software combination had to be cost effective, extremely user friendly in data base design, input, and maintenance as well as searching and output procedures.

For a small to medium size data base, PC-File III software running on an IBM PC/XT, or compatible, with a hard disk and printer met and/or exceeded all of these criteria.

After a short familiarization and test period, the input format was created and after four months of part time data entry, the system is completely operational. Open-file reports and maps are presently entered into the system the same day they arrive and data searches are performed regularly for both customers and Bureau employees. This system has proven to be a success.

Thursday, October 13,1988
10:30 a.m.–12:00 p.m.
Paper Session: Thematic Cartography - Columbine

Chair: Ruth Anderson Rowles, Graduate Student, Department of Geography, University of Kentucky–Lexington

Error in Global Cognitive Maps
Patricia P. Gilmartin
Associate Professor, Department of Geography, University of South Carolina
Robert E. Lloyd
Professor, Department of Geography, University of South Carolina

Geographers and other researchers who are interested in understanding the interface between people and space have found cognitive maps to be a rewarding topic of study. Topics as diverse as natural hazard perception, spatial/geographic learning, and perceived attributes and behaviors in large- and small-scale settings all have been explored through the vehicle of cognitive maps. The purpose of the study reported here was to elicit people's cognitive images of where various countries of the world are located and to identify the relative and absolute error associated with the locations. The cued spatial response method was used to obtain information about people's cognitive maps of the world. Each individual's cognitive map was fit to an actual map using the Waterman-Gordon algorithm, and indices were computed for error related to translation, rotation, and scaling. These three types of error are related to cognitive theories concerned with the encoding and decoding of spatial information. The functional relationship between distances on each individual's cognitive map and actual distances were computed. Significant differences among individual cognitive maps were investigated.

Landmark Representation on Street Maps

Ann Kielkopf Deakin
Graduate Student, Department of Geography, Penn State University

Landmark knowledge has been shown to provide both an aid in wayfinding and a framework from which to learn the environment. Although landmarks are important in wayfinding and environmental learning, most street maps include little to no landmark information. Considering the importance of landmarks in learning an environment and navigating through it, it seems reasonable that a street map should include supplemental landmarks (beyond tourist attractions) to reinforce what visitors see in a city, thus increasing their confidence when locating themselves in the city.

This study compares the success of three variations of a street map as a navigation aid. The first map includes supplemental landmarks represented by geometric symbols from a planimetric view, the second includes the same supplemental landmarks represented by stereotype sketches from a horizontal view (i.e. elevations), and the third includes no supplemental landmarks. To compare their effectiveness, each map is used by a different group of subjects in a simulated route following task. Comparing results for the three maps will show whether supplemental landmark information increases success when navigating in an unfamiliar city and if so, whether one method of landmark symbolization is more effective than the other.

Although this study is directed primarily at improving the success of paper street maps as navigation aids, it has implications for electronic route finders and vehicle navigation systems. Both usually include landmark information in their databases. This landmark data is compiled to serve as points of interest and trip origins and destinations. Information concerning the effectiveness of street maps with and without landmarks may help determine whether landmarks should also be incorporated in the route following assistance provided by these systems.

Maximizacion de la Receptiuidad del Mensaje Cartografico

Josefina Ostuni
Profesor, Instituto de Geografía, Facultad de Filosofía y Letras, Universidad Nacional de Cuyo, Mendoza, Argentina

La necesidad de lograr el máximo de eficiencia en la lectura de una carta incentivó la reflexión sobre cómo debía enfocarse. La elaboración de esta técnica apunta a desarrollar en el destinatario una mejor receptividad del mensaje contenido en el soporte cartográfico.

Los distintos pasos que abarca la lectura: localización, descripción y comparación, conducen a la regionalización o clasificación expacial que expresa las modalidades adquiridas por el espacio en relación con el fenómeno estudiado. La esquematización que se obtiene de la realidad, lograda por eliminación de lo accidental, permite alcanzar uno de los objetivos de la Geografía: descubrir el orden que subyace en la distribución del fenómeno analizado y con ello la delimitación de estructuras espaciales que ayudan a encountrar problemas que orientan la formulación de explicaciones.

A través de este procedimiento, el alumno logra una major comprensión y por lo tanto un mejor aprovechamiento de la carta, entendida como documento o como resultado de una elaboración. Esta forma de lectura, en cualquiera de los niveles de enseñanza, permite el desarrollo de una observación aguda y de una actitud crítica, y favorece además la organización creativa de la explicación. De este modo, lo dos términos del proceso enseñanza-aprendizaje, alumno y profesor, se interrelacionan por medio de un método de lectura que constituye la fuerze dinamizante del desarrollo de la clase de geografía en la cual el mapa no es un recurso agregado sino un elemento que se integra a la actividad didáctica, acrecentando el interés del alumno y haciendo realidad su participación activa. En síntesis, se dota al alumno de un medio que le permite reemplazar esquemas estereotipados por otros más creativos.

Maximization of Receptivity from the Cartographic Message

The need to obtain the maximum efficiency in map reading motivated the research on which this paper reports. The discussed technique develops in the reader a greater receptivity to a map's intended message.

The steps involved in map reading—localization, description, and comparison—lead to a spatial regionalization which expresses the modalities of the environment in relation to the studied phenomenon. The abstraction of reality, achieved by suppressing selected information allows the reader to realize one of the objectives of geography: the discovery of spatial order that underlies the distribution being studied and the identification of spatial structures, which are of value in the formulation of problems and subsequent explanations.

This procedure enables the reader to achieve a more thorough understanding, and thus, to take greater advantage of the map, whether it is used as a document or as the result of an elaboration. This mode of map reading, whatever the instructional level, permits the development of understanding and critical awareness, and favors creative explanations. Consequently, both ends of the teaching-learning process, the student and the instructor, achieve a better working relationship through the reading method. This approach constitutes the dynamic strength of a geography class in which the map is not an aggregated resource, but an integrated element of the didactic process, thereby increasing the interest of the student and his or her active participation. In brief, the student is given the means by which to replace stereotypical schemes with other more creative ones.

Friday, October 14, 1988
8:30 a.m.–10:00 a.m.
Paper Session: Mapping Systems - Columbine

Chair: David DiBiase, Graduate Student, Department of Geography, University of Wisconsin–Madison

Georgia's Approach to Developing a Statewide GIS
Arden Brey
Senior Consultant, Georgia Department of Community Affairs, State Cartographic Information Center

The purpose of this paper is to describe the approach being taken by state-level agencies in Georgia to encourage the development of integratable LIS/GIS within the state. It will also be the purpose of the presentation to solicit responses to those GIS development approaches that the state is considering.

The basic topic centers around what Georgia has done, and is likely to undertake in promoting, developing and integrating GIS/LIS components in the state. Sub-topics will include: 1) the situation in Georgia that requires an integrated approach to the development of LIS/GIS in Georgia; 2) what steps state agencies are currently taking; 3) what issues and factors we are likely to face; and 4) what are the most appropriate ways of resolving these issues.

An environment of intense interest in GIS is building in many government agencies across the state. Seven county governments and five state departments have, or are developing various components of GIS/LIS, without benefit of coordination. Several more units of state and local governments are preparing to do so. The General Assembly has created a "State Mapping and Land Records Modernization Advisory Board" to study and recommend what Georgia governments should be doing to take best advantage of LIS/GIS technology.

Visibility Modeling Using Triangular Networks

Douglas J. Dudycha
Assistant Professor, Department of Geography, University of Waterloo

Triangulated irregular networks provide a convenient method of representing terrain for purposes of surface modeling and cartographic display. This paper describes an algorithm for partitioning a triangulated network into visible and hidden sub-regions relative to a specified viewpoint. Processing occurs in two stages. In the first stage, back-facing triangles are flagged and ridge lines which may partially or fully hide more distant front-facing triangles are identified. In the second stage, front-facing triangles are identified. In the second stage, front-facing triangles are clipped against the ridge lines to complete the partitioning into visible and hidden sub-regions. A local search procedure based on adjacent triangle pointers is used to minimize the number of traingles which must be checked during the clipping phase.

Results of preliminary tests of the visibility algorithm are presented and applications in generating three-dimensional views of a surface are discussed. Test results indicate that the algorithm provides an efficient means of determining surface visibility. Display procedures are found to be greatly simplified since visibility is determined prior to perspective transformation. Perspective outline plots, raised contour and transect plots are easily generated from the set of visible triangles. Triangles may be shaded based on slope and aspect and other attributes (e.g. soil, land use, vegetation, etc.) may be associated with visible triangles using polygon overlay techniques.

Automated Filtering of Redundant Data Points in a Triangulated Irregular Network Digital Elevation Model

John Geddes
MA Candidate, Department of Geography, University of Waterloo

The most common approaches to digital elevation modelling employ either a regular grid or a triangular mesh to represent a surface. The major criticism of the grid approach is that use of a regular grid is not responsive to surface variations, requiring that grid resolution be adjusted to the roughest terrain, thereby creating redundant grid points in areas of smooth terrain. The triangulation approach links neighbouring data points to form a mesh of contiguous, non-overlapping triangles in which each triangle vertex is a data point. This method adapts naturally to variations in surface roughness, thereby avoiding the redundancy inherent in the regular grid approach. However, most popular triangulation methods are strictly two dimensional, in the sense that the elevation coordinate is not considered during triangulation.

An alternate triangulation procedure which avoids this drawback is triangle partitioning, where a data point is inserted inside a parent triangle to create three new triangles. During insertion, each data point can be tested for its significance in describing the surface based on its elevation, and eliminated if found insignificant. The implication is that a surface can be represented by fewer data points without a corresponding loss in accuracy. However, continual partitioning of triangles tends to create undesireably long and narrow triangles, a problem that can be solved with an optimization procedure to minimize the length of triangle sides. Most partitioning algorithms perform this operation following triangulation, and without respect for the character of the terrain.

This paper presents an algorithm based on triangle partitioning, but with an optimization routine invoked each time points are inserted. The result is a mesh comprised of nearly equilateral triangles, requiring only those data points essential to describing the surface, and which honours the integrity of the surface.

Friday, October 14, 1988
8:30 a.m.–10:00 a.m.
Paper Session: Carto-Technologies - Vail

Chair: Les Barker, Cartographer/General Services Department, The World Bank Washington, D.C.

ATLAS*DRAW©: The New Generation
P. Blake McCully
Systems Analyst, Department of Geography and Regional Planning, Indiana University of Pennsylvania, Indiana, PA

ATLAS*DRAW© produced by Strategic Location Planners is a polygon encoding program that replaces Mapedit©. The changes are very dramatic. The program includes improvements to all the features of Mapedit© as well as adding new features that enhance the usefulness of the program.

Users who have no experience with other SLP® products will possibly encounter less difficulty in the beginning than will those who have long experience with Mapedit©. The primary reason for this problem is the use of sliding menus rather than the function keys to perform most operations. A wider range of digitizers and mice are supported with ATLAS*DRAW© than with Mapedit©. Although cursor buttons are not defined during the installation process, this may be accomplished by editing the file named ADMACRO.KEY. The Boundary-Embedded command makes creating embedded polygons simpler because the aggregation and redigitizing steps have been eliminated. The control points for digitizing a paper map may be saved in a file and recalled on each new session, no redigitizing is necessary if the map has not been moved. The Vertex Command allows a full range of editing tasks which are performed on selected regions or curves. Corridors may be created around linear features such as streams or roads specified by map distance (units, miles, feet, etc.). Rings may be created around points by a specified map distance. The Boundary Command allow feature types to be changed from one type to another, it can also create a file which contains valuable information about selected boundaries.

ATLAS*DRAW© is the perfect companion for ATLAS*GRAPHICS©. Although there are some minor problems adapting to the environment of the program these are readily overcome with use.

The Changing Cartography Laboratory: Traditional Mapping to Computer Graphics
Dr. Dennis M. Richter, AICP
Professor of Geography, Department of Geography, University of Wisconsin-Whitewater, Whitewater, WI

Undergraduate cartography laboratories have generally served as traditional technique support facilities for the students of geography, planning, and other cognate fields. That role required students to be familiar with compiling charts, graphs, maps, and passing familiarity with surveying and air photo methodology.

During the 1980's many college cartography labs have changed from a traditional mechanical drawing sequence of courses to courses employing computer graphics and analysis to bring greater meaning to the statement "a map is worth a thousand words."

The Department of Geography at the University of Wisconsin-Whitewater has moved through this transition during the 1980's. The basic cartography course now includes statistical analysis using both microcomputer and mainframe software, computer graphics with emphasis on multicolor maps, charts, and graphs using commercial and locally developed

software, a field surveying project in which the final map is digitized and produced on a plotter, and various computer maps such as choropleth, 3-D bar, and proportional circle. The students in the course are no longer prepared to simply trace a map for another course but to manipulate data from a geographical information data base and place the information on computer generated base maps pertinent to their topic. Urban and regional planning students have access to large-scale maps, while regional geography classes have access to small- and medium-scale maps and appropriate data base information. All students are familiarized with the use of 3 different digitizers and plotters if they wish to generate original information, and have access to Atlas Graphics, pcARCinfo, and several locally developed programs. In addition, the use of the integrated SMART software allows students to compile a variety of charts from spreadsheet data, subject the data to statistical analysis, and place data and charts into a word-processed document. MINITAB and EZYGRAF statistical and graphic software is accessed through the University's DEC VAX11/780 and printed on Departmental mainframe terminals and plotters. The change from traditional pen and ink cartography has challenged students and substantially increased interest in the advanced classes in computer mapping. Furthermore, the systematic and regional classes in the Department have seen considerable increase in the use of statistical analysis, maps, charts, and graphs in term papers and research reports because computer systems are much easier and faster to work with than traditional cartographic methods. Finally, placement of cartography enriched students after graduation has increased substantially because of the added dimension in their overall program, and the job market demand for these skills. Planning department, environmental orgranizations, state and federal agencies, and private consulting firms using computer graphics have provided ready employment for this new generation of cartography student.

An Advanced Hardware and Software Solution to Geoprocessing

Darrell McGregor
Technical Applications Specialist, GeoVision Systems Inc., Aurora, CO

Automated mapping and geoprocessing technology has moved into a new era. Once considered a costly and emerging technology, cost effective and production-oriented systems are now available. The system described is modeled on a multi-application and multi-user type organization, requiring a high performance, unified cartographic and attribute database that may be distributed to a wide variety of users. This approach offers organizations decentralized custodianship of information to end users and centralized database administration of corporately-owned data.

The latest advance in hardware and software technology are now available in an integrated solution to meet the needs of geographically-related information users. The introduction of Local Area Network and engineering workstation technology makes it feasible to distribute processing and databases to the end-users, while maintaining centralized administration using powerful minicomputer technology. Software advances include interactive graphics technology which provide an easy-to-learn, friendly interface through the use of multiple windows, pull-down menus and pop-up forms. More importantly, the introduction of relational database management system software integrates cartographic and other attributes into a unified and continuous, geographically referenced database, accessible through a geographic query language.

The systems available today make it cost effective for organizations to corporately build, manage and maintain an intelligent multi-applications/multi-user geographically-referenced database.

Friday, October 14, 1988
10:30 a.m.-12:00 p.m.
Special Paper Session: Managing Map Collections - Columbine

Session Organizer: Johnnie D. Sutherland, University of Georgia Libraries-Athens

Participants:
Chris Baruth
American Geographical Society
Hull McLean
Department of State
Diana Rivera
Michigan State University

Friday, October 14, 1988
1:30 p.m.-3:00 p.m.
Paper Session: Canadian and Latin American Cartography - Vail

Chair: J. Hull McLean, Geographic Specialist, Department of State, Washington, D.C.

Canadian Cartography and the Cartographic and Architectural Archives Division, National Archives of Canada
Louis Cardinal
Chief, Collections Section, Cartographic and Architectural Archives Division, National Archives of Canada

The first part of this paper will briefly examine the major government (federal, provincial, municipal) and private map producers in Canada, their products, and their interrelationships. Map procurement will also be discussed. In the second part, the paper will outline the acquisition programmes and holdings of the Cartographic and Architectural Archives Division, National Archives of Canada.

A Brief on the 5th Edition of the National Atlas of Canada
Dan Mackay
Senior Geographer, Geographical Research, Geographical Services Division, Canada Centre for Mapping, EMR Canada

La Cartografia en Costa Rica (Breve Reseña Historica)
Ing. Rodrigo Vega Herrera
Presidente, Colegio de Ingenieros Topografos

Este trabajo tiene como objeto dar a conocer una breve historia de la cartografía en Costa Rica.

Durante la colonización por parte de España, no se tienen mapas ni croquis, y fue hasta 1869 que se tuvo conocimiento de algunos croquis de nuestro país.

El primer mapa de Costa Rica se editó en el año de 1903 y fue elaborado por el Dr. Henri F. Pittier connotado científico suizo, que trabajó en el país y que fue el primer Director del Instituto Físico-Geográfico. Luego del mapa del Dr. Pitter se elaboraron algunos mapas en los años de 1913 y 1933.

En el año de 1942 con la demarcación de los límites de Costa Rica con la República de Panamá se interesaron nuestras autoridades en la Cartografía del país y se crea el Instituto Geográfico Nacional, y al poco tiempo de fundado se establece la Agencia Norteamericana, mediante el Servicio Geodésico Interamericano (I.A.G.S.), dependencia del Army Map Service de los E.E.U.A.

El I.A.G.S., termina la compilación y reproducción aereofotogramétrica de nuestro mapa básico, para lo cual se utilizó como experimentación la Proyección Conformante de Lambert y se utilizó un Datum provisional de ocotepeque, Honduras. El resto de Centroamérica lo hizo utilizando el Datum Norteamericano y la Proyección Transversa de Mercator (UTM).

En la actualidad tenemos completo nuestro mapa básico que consta de 133 mapas.

La enseñanza de la cartografía se ha realizado en nuestro país a través de la Escuela Cartografíca del Servicio Geodésico Interamericano, sita en la República de Panamá, además que en dos de nuetras Universidades se preparan profesionales en el campo de la Topografía, Catastro y Geodesia, en cuyos cursos se incluye la Cartografía.

Cartography in Costa Rica: A Brief Historical Review

Maps or line drawing of Costa Rica are not known to exist from the Spanish Colonial Period (1502–1821). The first documented line drawing of the country did not appear until 1869. Dr. Henri F. Pittier, a renowned Swiss scientist, and the first Director of the nation's Geophysical Institute, was the first to compile and publish a map of Costa Rica in 1903. Revisions of Dr. Pittier's map were published in 1913 and 1933.

In 1942, with the demarcation of the Costa Rican–Panamanian border, the government became interested in cartography and established the National Geographical Institute. Shortly thereafter, the North American Agency, a division of the Inter American Geodetic Survey (I.A.G.S.) of the U.S. Army Map Service was founded.

The I.A.G.S. has compiled and reproduced photogrammetric base maps of the country on which we experimented with the Lambert Conformal Projection using the provisional datum of Ocotpeque, Honduras. The rest of Central America has been mapped using the Universal Transverse Mercator (UTM) Projection based on a North American datum. National coverage consists of 133 maps.

Our cartographers receive their training in various institutions. Many have been trained at the School of Cartography of the Inter American Geodetic Service, in the Republic of Panama. Others are trained as cartographers, topographers, surveyors, and geologists in Costa Rican universities.

Friday, October 14, 1988
1:30 p.m.–3:00 p.m.
Paper Session: Remote Sensing – Columbine

Chair: Jeffrey C. Patton, Associate Professor of Geography/Cartography, University of North Carolina at Greensboro

Worldwide Mapping Using Satellite Imagery: The Utility of SPOT Imagery for Cartographic Applications

Seth I. Gutman
Carterra Incorporated, Golden, CO

While the value of accurate maps and photoimage coverage cannot be overstated, anyone who has obtained and used published maps can attest to the fact that they are commonly out of

date and sometimes unavailable. It is not unusual to have substantial variations in the scales and degrees of map coverage within a limited geographic area, making it difficult to compile large area map coverage with a uniform accuracy and appearance. In many cases, this poses a severe problem to the user; one that is magnified in the developing world, where maps at scales larger than 1:250,000 are uncommon, usually out of date, sometimes inconsistent and of widely varying quality.

The status, degree of coverage, availability and accuracy of generally available worldwide mapping is difficult to estimate. A United Nations survey, performed in 1980 and updated in 1986 (soon to be released by the U.N. and unavailable at the time this article was being prepared), summarizes the scope of world-map coverage according to the following conventions: scales larger than 1:25,000; 1:50,000; 1:100,000; and 1:250,000. An independent assessment, unrelated to the U.N. survey, estimates that approximately 10% of the countries are mapped at scales larger than 1:25,000 and less than 25% at scales larger than 1:50,000.

There are, of course, numerous reasons for the lack of adequate map coverage, including economic, logistical and national security considerations. The fact that conventional mapping techniques are expensive, time consuming, and occassionally dangerous does not ameliorate the situation, nor does understanding it satisfy the sometimes urgent requirements of nations, academic institutions, private companies, and individuals to have current and accurate geographic information available.

Until the advent of commercial, high resolution satellite remote sensing, however, the only practical method for generating and updating regional map information was aerial photography and the application of conventional photogrammetric techniques to topographic mapping and orthophotographic compilation. This article discusses the applicability of SPOT satellite data as a substitute for, or alternative to, high altitude aerial photography for certain applications. Satellite imagery with ten meter resolution is not perceived as a replacement for conventional aerial photography. However, recent investigations of the geometric, spatial and radiometric characteristics of digital SPOT data indicate that highly detailed and accurate satellite image maps may be routinely created at map scales larger than 1:25,000 (one centimeter equals 250 meters), making it a satisfactory alternative in many circumstances.

In practical terms, the resolution limitations of current satellite data mean that while individual trees may not be discernible on a SPOT Panchromatic image, stands of trees almost certainly will be. The economic viability of satellite imagery as a substitute for conventional aerial photography, therefore, is determined by the trade-offs between resolution requirements, total project costs, and associated logistical factors including final-product delivery time. Each project must be evaluated within the context of the final objectives and budget constraints.

Reconaissance Survey of Land Resources, Los Tuxtlas, Mexico: Holistic Integration Landscape Approach

Maria Concepcion Garcia Aguirre
Universidad Nacional Autonoma de Mexico, Distrito Federal, Mexico

A reconaissance survey of land resources was carried out in Los Tuxtlas, Veracruz, Mexico using a holistic integration landscape approach. The analysis of the results provided information on the present degree of deterioration of a former dense and intricate forest.

Following the steps of a very general land evaluation some ideas are proposed in order to achieve the conversation and regeneration of the area.

Remote sensing products were used to elaborate maps: aerial photographs from 1967 and 1976, a Multispectral (MSS) computer compatible tape of 1979 and a Thematic mapper computer compatible tape of 1986. The latter was analyzed with digital-image processing using a maximum likelihood classification program. Sampling was done following a method derived

from the phyto-sociological approach. Vegetation data were analyzed with the MAINFLEX and TWINSPAN classification programs and the CANOCO program was used for the searching of environmental correlations.

Ten vegetation types were obtained from the comprehensive analysis of the area: Low evergreen forest or elfin forest; *Quercus-Ulmus* forest; *Chionantus-Ulmus-Randia* forest; *Belotia-Maclura* forest; *Virola-Juglans-Chionantus* forest, rain forest, old and young acahual (secondary vegetation) and several kinds of grasslands. Altitudinal differences showed high correlation with the vegetation.

A land unit map scale 1:50,000 reveals the situtation in an area about 900 km^2. Another map of a smaller area illustrates qualitative estimation of the vegetation changes that occurred between 1976 and 1986.

Saturday, October 15, 1988
9:00 a.m.–11:15 a.m.
Paper Session: General Cartography - Vail

Chair: Patrick H. McHaffie, Kentucky Geological Survey

The Role of the National Ocean Service (NOS) in the Cartographic Marketplace
Martha Soneira
Aeronautical Charting Division, National Ocean Service, National Oceanic and Atmospheric Administration

Technological innovation, changing user demands and legislated price increases are challenging the National Ocean Service (NOS) within the National Oceanic and Atmospheric Administration (NOAA) to redefine its role in the marketplace for cartographic products. A brief history of the NOS public service mission explains the natural progression to a marketing strategy, which was preceded by successful programs of other agencies within the Federal sector.

This paper discusses how the NOS incorporates the requirements of policy directives with user needs in a marketing program developed to fulfill its mission goals of supporting safe and efficient air and marine transportation, meeting positioning and elevation control requirements, improving public awareness of NOAA's charting, surveying and data distribution responsibilities and developing user-oriented policy, products and services.

Map Supplement Design, National Geographic Society
Robert E. Pratt
Senior Map Designer, Cartographic Division, National Geographic Society

Creation of map supplements to the magazine goes beyond the normal reader's imagination of the process of portraying information. From the initiation of an idea to the printing dates, each map runs the guantlet of decisions and processes that try to guarantee comprehensive and concise coverage supported by appropriate consultants of varying professions and technologies.

With the assistance of numerous computer graphic abilities and photographic techniques all the components to each map are handled by researchers—compilers, designers, draftsmen, writers, typesetters, editors to mention a few. All play a part in the overall design and ultimate success of a supplement.

The path one supplement took from concept to mailing will be covered regarding all the above; and will be expressed with the help of slides and props.

Technical and Stylistic Changes in Types on National Geographic Maps, 1889–1988
Barbara Mullin
Department of Geology and Geography, Hunter College

This is an examination of type style development in the National Geographic Society maps over a period of one hundred years. It examines the initial purpose of the organization and its maps and the changes over time in both. The influences of changing technology, styles, audiences and personalities upon the look of the maps are also examined. Included in this study is a look at the nature of commercial mapping and the constraints imposed by its strict requirements. I am interested in seeing how these influences shaped the look of the maps and, in turn, the influence NGS map design and type usage has had on other map products.

Saturday, October 15, 1988
9:00 a.m.-11:15 a.m.
Paper Session: Navigational Charting Systems - Columbine

Chair: Diana Rivera, Michigan State University-East Lansing

LORAN C: General Aviation's Navigation System for the Future
Ronald M. Bolton
Chief of the Aeronautical Chart Branch of the Aeronautical Charting Division at the National Ocean Service (NOS), Rockville, Maryland

LORAN C is the computer-age version of a 43-year-old navigation system called "LORAN" (LOng RAnge Navigation), which has been used by boaters for years and is now being utilized by aviation. It has a range of over 2,000 miles and the receivers are light and inexpensive. The FAA has granted approval for operation in Visual Flight Rule (VFR) and Instrument Flight Rule (IFR) Enroute flights in designated areas. FAA is also developing standards for receiver approval and certification criteria for non-precision approaches.

Several problems exist in LORAN C navigation but there are available viable solutions to these problems. Most of the current aviation LORAN C systems supply all the information pilots need for accurate navigation (± 600 feet if correction tables are available).

Aviation leaders are enthusiastic about LORAN C as an enroute and terminal area approach system. It will open up thousands of smaller airports for instrument operation at almost no cost. LORAN C is an ideal navigation system for general aviation; it is low cost, simple to operate, accurate and reliable. The future for LORAN-C is now!

Microwave Landing Systems: The Future Approaches
Russell Hoover
Cartographer, National Ocean Service (NOS), Rockville, Maryland
Claudet Dellon
Computer Specialist, National Ocean Service (NOS), Rockville Maryland
Ronald M. Bolton
Chief of the Aeronautical Branch of the Aeronautical Charting Division at the National Ocean Service (NOS), Rockville, Maryland

Simulation and actual tests performed with the Microwave Landing System (MLS) in the air traffic control system support claims for expected operational benefits of this improved landing system. The MLS results in a reduced number of communications between the pilot and controller, less flying time during the approach, and greater variety of approach pattern and descent angles.

If we had known 40 years ago what we know today, there would never have been an Instrument Landing System (ILS). As far back as the 1940's, when ILS was developed, its designer knew that much higher radio frequencies would provide superior precision approach guidance. Unfortunately, the technology to build microwave ground stations and airborne receivers just didn't exist. Through compromise, ILS was a technologically feasible alternative.

MLS is a technically superior landing system, but ILS is here now, both on the ground and in our aircraft. Cost is a large factor in the decision to use MLS or to stay with ILS. However, MLS can be used where ILS can not perform because of difficult terrain and/or interference problems. ILS has served us well for more than 40 years and will be with us for another decade or two but MLS will become an important landing system during the next decade and will perform well into the next century. MLS is a system for the future.

Quality Control Procedures for Digital Data Utilized for Navigation in the National Airspace System

Claudet Dellon
Computer Specialist, National Ocean Service (NOS), Rockville, Maryland
Ronald M. Bolton, Chief of the Aeronautical Chart Branch of the Aeronautical Charting Division of the National Ocean Service (NOS), Rockville, Maryland
Robert Niedermair
Computer Specialist, National Ocean Service (NOS), Rockville, Maryland

The Aeronautical Chart Division (ACD) produces a variety of charting, navigation, and digital data products for the aviation community and the Federal Aviation Administration. The ACD also supplies digital data to the FAA for special programs; two significant examples of this data are navigational aid (NAVAID) data and elevation data for the Minimum Safe Altitude Warning System (MSAW).

Digital data is produced every 56 days by the ACD for delivery to the FAA Air Traffic Control (ATC) Facilities. In the Fall of 1985, when NAVAID was switched from magnetic tape to floppy disk format, a contractor began the duplication and distribution of the NAVAID data. The need for strict quality control was demonstrated; of the first 7 or 8 sets of diskettes which were sent out, half were bad! Some had errors, some were blank and the others were physically damaged.

The solution to the problem was to utilize data transmissions protocol concepts in a program called DATCHK. DATCHK computes checksums for vertical and horizontal components of the character codes and records. DATCHK is run on all disks before shipment; the end user also runs DATCHK to ensure the data is correct and complete. Should DATCHK discover damaged or incomplete records when run by the user, the user is supplied with NOAA's address and toll-free number and notified that he can obtain a replacement disk free of charge.

By using the DATCHK program in quality control of navigational data, both NOAA and the user can be assured that only valid data is used in the field. Thus, the ACD can expand its distribution of digital data for aeronautical navigation and control systems with confidence that the safety of the National Aerospace System is being properly safeguarded.

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