

# PE&RS

Photogrammetric Engineering Remote Sensing

Volume LV

May 1989

Number 5 Part 1

## High Altitude Laser Ranging over Rugged Terrain

When the laser measurements were combined with measurements of instrument position and orientation by an inertial system between camera stations, analysis showed that the combined system can give a terrain elevation profile with an accuracy of a few decimetres or a few metres.

*N.H. Thyer, J.A.R. Blais, and M.A. Chapman*..... 559

## Analytical Independent Model Triangulation Strip Adjustment Using Shore-Line Constraints

Results show an improvement in the RMS errors in height and planimetry of approximately 19.5 percent and 8.5 percent, respectively.

*Mohamed Shawki Elghazali*..... 567

## A Semi-Automatic Terrain Measurement System for Earthwork Control

An operator-assisted procedure for DTM collection is described.

*Susumu Hattori, Shunji Murai, Hitoshi Ohtani, and Ryosuke Shibasaki*..... 573

## Digital Photogrammetric Processing Systems: Current Status and Prospects

Prospects indicate that the time has come for Digital Stations with truly photogrammetric functions to be used in a fully automatic and interactive mode and with high-accuracy capabilities.

*Armin W. Gruen*..... 581

## The Nebraska Center-Pivot Inventory: An Example of Operational Satellite Remote Sensing on a long-Term Basis

The history, procedures, and results of a long-term program of inventorying center-pivot irrigation systems in

Nebraska is summarized.

*Donald C. Rundquist, Richard O. Hoffman, Marvin P. Carlson, and Allen E. Cook*..... 587

## A Method for Integrating Remote Sensing and Geographic Information Systems

A relational image-based GIS (RIGIS) has been developed for efficiently integrating geobased information and remotely sensed data using spatial modeling techniques.

*Qiming Zhou*..... 591

## Close-Range Photogrammetric Measurement of Erosion in Coarse-Grained Soils

The method allows the overall surface to be adequately represented by measurements at spacings indicated by the macrotopographic surface roughness, rather than those associated with individual soil particles.

*J. Sneddon and T.A. Lutze*..... 597

## Fractal Analysis of a Classified Landsat Scene

Fractal concepts are used to describe land-cover patterns, to improve the classification of digital remotely sensed data, and to create GIS data structure.

*Lee De Cola*..... 601

## N-Dimensional Display of Cluster Means in Feature Space

The display can be created using an X-Y graph and the monocular depth cues of size, thickness, brightness, and color.

*Michael E. Hodgson and Reese W. Plews*..... 613

## Book Reviews

*Remote Sensing of Shelf Sea Hydrodynamics*..... 565

*Fundamentals of Digital Image Processing*..... 572

### PE&RS

Photogrammetric Engineering & Remote Sensing (ISSN 0099-1112) is published monthly by the American Society for Photogrammetry and Remote Sensing, 210 Little Falls St., Falls Church, VA 22046. Second-class postage paid at Falls Church, Virginia and at additional mailing offices.

### SUBSCRIPTIONS

Subscription rate for nonmembers is \$110.00 per calendar year (add \$20.00 for international subscriptions). Membership dues include annual subscription to PE&RS (\$24 members and \$11 student member). This subscription price is part of membership benefits and cannot be deducted from annual dues. Foreign Airmail subscription is \$190.00; US First Class Mail subscription is \$140.00. POSTMASTER: Send address changes to PE&RS, ASPRS Headquarters, 210 Little Falls St., Falls Church, VA 22046.

### MEMBERSHIP

Membership in the Society is open to any person actively engaged in the practice of photogrammetry, photointerpretation, remote sensing, and geographic information systems; or who by means of education or profession is interested in the application or development of these arts and sciences. The annual dues for Regular members are \$45.00 Annual dues for accredited Student members are \$18.00. Add \$15.00 for all international memberships to cover cost of postage. (All memberships are on a calendar year basis.) Printed in the United States of America.

Copyright 1989 by the American Society for Photogrammetry and Remote Sensing. Reproduction of this issue or any part thereof (except short quotations for use in preparing technical and scientific papers) may be made only after obtaining the specific approval of the Editor. The society is not responsible for any

statements made or opinions expressed in technical papers, advertisements, or other portions of this publication.

### PERMISSION TO PHOTOCOPY

The appearance of the code at the bottom of the first page of an article in this journal indicates the copyright owner's consent that copies of the article may be made for personal or internal use or for the personal or internal use of specific clients. This consent is given on the condition, however, that the copier pay the stated per copy fee of \$2.25 through the Copyright Clearance Center, Inc., 21 Congress Street, Salem, MA 01970, for copying beyond that permitted by Sections 107 or 108 of the US Copyright Law. This consent does not extend to other kinds of copying, such as copying for general distribution, for advertising or promotional purposes, for creating new collective works, or for resale.





COVER PHOTO: A portion of the San Diego harbor is shown as depicted on the standard line map and on the new SPOT image map. The line map was revised in 1975 while the SPOT image map was recorded in 1986. Both are USGS products printed back-to-back at 1:24,000 scale, and titled "Point Loma (32117-F2-SI-024)." Note the differences in the waterfront facilities. SPOT Image data copyright © 1986 CNES.

**Building Fund Status** .....528

**The Photogrammetric Society, London**.....530

**Features**

GIS News .....532

Newsletter.....540

Engineering Reports.....548

AVHRR .....558

Calendar.....622

Classifieds.....625

The ASPRS Store .....632

ASPRS Membership Application.....636

**Society Affairs**

New Sustaining Member, *Chicago Steel Tape Company*.....512

New Sustaining Member, *GeoSpatial Solutions, Inc.* .....512

Officers of the Society.....523

Sustaining Members.....546

GIS for Resource Management: A Compendium .....580

New Sustaining Member, *TASC* .....596

New Sustaining Member, *Ashtech, Inc.*.....596

New Sustaining Member, *TGS Technology, Inc.* .....600

New Sustaining Member, *Aerial Cartographics of America (ACA), Inc.* .....610

New Sustaining Member, *Trimble Navigation, Ltd.*.....610

New Sustaining Member, *AT&T's Digital Record Systems* .....619

Non-Topographic Photogrammetry, 2nd Ed.....621

Multilingual Dictionary.....624

GIS Video.....631

Air Spy.....635

**Journal Affairs**

Permission to Photocopy.....510

Journal Staff.....511

What *Photogrammetric Engineering and Remote Sensing* is.....511

Forthcoming Articles.....571

Call for Papers, Special Interfacing GIS/Remote Sensing Issue.....612

Instructions to Authors.....620

Index to Advertisers.....630

**Announcements**

Call for Papers, Multiresource Management of Ponderosa Pine Forests.....512

International Training Program in Remote Sensing.....590

1989 Fall Convention.....611

PHOTOGRAMMETRIC ENGINEERING & REMOTE SENSING is the official journal of the American Society for Photogrammetry and Remote Sensing. It is devoted to the exchange of ideas and information about the applications of photogrammetry, remote sensing, and geographic information systems.

ASPRS has adopted the following definition: Photogrammetry and Remote Sensing are "the art, science and technology of obtaining reliable information about physical objects and the environment, through the process of recording, measuring and interpreting imagery and digital representations of energy patterns derived from noncontact sensor systems." Conventional photogrammetry includes the compilation of topographic maps and surveys, complete with contour lines, based on measurements and information obtained from aerial and space photographs with optical analog instruments and/or analytic instruments/computations. Similar topographic principles of precision measurement are applied in close-range photogrammetry, to map (measure) objects that are difficult to study in other ways, such as the shape of an astronomic radio reflector subject to environmental deformations, for synoptically recording measurable deformations in engineering models, for the medical study (in situ) of live specimens, etc.

Remote Sensing uses imagery acquired with a sensor other than (or in addition to) a conventional camera, such as by electronic scanning, or using electromagnetic radiations outside the normal visual range of the film and camera — microwave, radar, thermal infrared, and ultraviolet, as well as multispectral. Special techniques are applied to process and interpret remote-sensing imagery for the purpose of producing conventional maps, thematic maps, resource maps, digital data files for GIS, surveys, etc., in the fields of agriculture, archaeology, forestry, geography, environmental sciences, geology, and others.

Geographic information systems are the computer hardware/software used to input, store/retrieve, manipulate/analyze, display, and plot/print spatially referenced digital data (e.g. digitized maps, remote sensor, tabular data, etc.). Thus a GIS is comprised of three essential subcomponents: computer hardware, computer software, and various types of digital data.

**JOURNAL STAFF**

**Editor-in-Chief:** James B. Case  
**Director of Communications:** Donald F. Hemerway, Jr.  
**Newsletter Editor:** William D. Lynn  
**Manuscript/Advertising Manager:** Jean P. Engel  
**Engineering Reports Editor:** Willard A. Kuncis  
**Staff Editor/GIS News Editor:** Mary F. Draisker

**Associate/Assistant Associate Editors**  
**Geography, Forestry & Plant Sciences:** William J. Ripple  
**Geology, Water Resources, Hydrology:** Michael Abrams  
**Geography and Land Use:** John R. Jensen  
**Professional Practice-Practical Papers:** John Grimson Lyon  
**Geographic Information Systems:** James W. Merchant  
**Primary Data Acquisition:** Elizabeth A. Fleming  
**Theoretical & Applied Photogrammetry:** Clive S. Fraser  
**Book Review Editor:** James B. Campbell

Correspondence relating to all business and editorial matters pertaining to this and other Society publications should be directed to the American Society for Photogrammetry and Remote Sensing, 210 Little Falls St., Falls Church, VA 22046, including inquiries, memberships, subscriptions, changes in address, manuscripts for publication, advertising, back issues, and the MANUALS OF PHOTOGRAMMETRY AND REMOTE SENSING. The telephone number of the Society Headquarters is 703-534-6617; the fax number is 703-533-9614.