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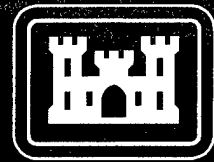
Bibliography of In-House and Contract Reports, Supplement 20

Jean R. Diaz

October 1996

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U.S. Army Corps of Engineers
Topographic Engineering Center
7701 Telegraph Road
Alexandria, Virginia 22315-3864

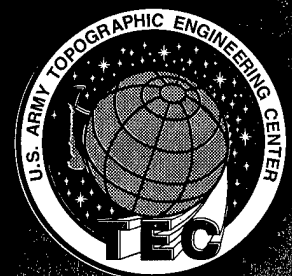


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PREFACE

This is Supplement 20 to the report titled, "Bibliography of In-House and Contract Reports" AD-877 653L; Supplement 1, AD-890 066L; Supplement 2, AD-905 548L; Supplement 3, AD-B005 275L; Supplement 4, AD-B010 642L; Supplement 5, AD-B019 966L; Supplement 6, AD-055 468; Supplement 7, AD-A068 744; Supplement 8, AD-A084 111; Supplement 9, AD-A099 803; Supplement 10, AD-A113 006; Supplement 11, AD-A128 400; Supplement 12, AD-A141 778; Supplement 13, AD-A160 607; Supplement 14, AD-A173 750; Supplement 15, AD-A195 953; Supplement 16, AD-A215 154; Supplement 17, AD-A252 543; Supplement 18, AD-A265 475; and Supplement 19, AD-A295 530. It is a continuing bibliography of reports prepared by and for the U.S. Army Topographic Engineering Center, Alexandria, Virginia. This bibliography includes reports that were published from 31 October 1994 through 1 October 1996.

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Colonel Robert F. Kirby was the Commander and Acting Director of the Topographic Engineering Center at the time of publication.

TEC-0059

AD A296 595

**AN INVESTIGATION OF KERNELS FOR SHADING
OF ELEVATION DATA
May 1995**

Michael M. McDonnell

Keywords: Terrain Visualization, Elevation, Shaded Relief, Terrain Display, Geographic Data

This report examines the results of enhancing displays of an elevation array by using mathematical shading. The variable examined in this report is the shape of the primitive region by which shading is calculated. This primitive region is called a kernel. Three kernels are examined: triangles, quadrilaterals (actually squares), and a hybrid shape that seemed as though it might have fewer artifacts. The result is that shaded quadrilaterals seem to be more isotropic and have fewer artifacts than the other shapes examined. Shading using quadrilateral kernels also is the easiest to calculate. All shading was done using the Gouraud technique.

TEC-0060

AD B195 984L

**DECISION AID FOR INTEGRATED AIR DEFENSE PLANNING
October 1994**

Richard Vargus
Terry Dueck

Systems Control Technology, Inc.

DACA76-91-C-0022

Keywords: Defense, Computer-Aided, Modeling, Weapons

Technological sophistication of modern air defense weapons systems, and plans for integrating existing and future SAM/ATM systems, have created a need for theater air defense mission planning systems to aid in the air defense planning process. These systems focus on providing the air defense planner with tools to rapidly and intelligently respond to the dynamics of the battlefield environment. The objective of the Air Defense Command and Control Systems (ADCCS) office is to create an interoperable network of systems that provides force level and functional commanders at corps level and below with the means to synchronize the forces. The development of tactical decision aids designed to aid the planner in creating an effective air defense is well within this area of interest.

TEC-0061

AD A296 397

**VISION-BASED NAVIGATION AND RECOGNITION,
SECOND ANNUAL REPORT
June 1995**

Azriel Rosenfeld

University of Maryland

DACA76-92-C-0009

Keywords: Parallel Algorithms, 3-D Recovery, Motion Analysis, Vision-Based Navigation, Object Recognition

This report summarizes image understanding research dealing with many aspects of both navigation and recognition. This research has dealt with the following ten areas: (a) Parallel algorithms, (b) Invariant properties, (c) Image registration, (d) 3-D recovery, (e) Motion analysis, (f) Vision-based navigation, (g) Function-based recognition, (h) Face recognition, and (i) Document understanding. The work done in these areas is summarized in Sections 2-10 of this report. Further details about this work can be found in 12 technical reports issued on the Contract during the period April 1993 - March 1994. A bibliography of these reports is given in Section 11 of this report; the numbers in brackets in Sections 2-10 refer to this list.

TEC-0062

AD A296 870

**A SYSTEM FOR AUTOMATED SIGHT MODEL ACQUISITION
AND EXTENSION - RADIUS
June 1995**

Robert Collins
Edward Riseman
Allen Hanson

University of Massachusetts

DACA76-92-C-0041

Keywords: Aerial Image Understanding, Feature Extraction, Site Modeling, Image Extraction

The goal of the Research and Development for Image Understanding Systems (RADIUS) project is to develop image understanding (IU) algorithms that support model-based aerial photo interpretation. This report, funded under a 3-year contract to develop algorithms for automated geometric sight modeling, describes research activities performed during the first year, October 1992 through October 1993.

THE ALBE GRIDDED VISIBILITY MODEL

May 1995

Vernon Stoltz

Keywords: Visibility, Line-of-Sight, Tactical Decision Aid, Elevation, Digital Terrain

The AirLand Battlefield Environment (ALBE) visibility model provides a new method of calculating Line-of-Sight visibility products derived from digital terrain elevation data. This new method uses a gridded raster approach rather than the historical vector approach. The basic principles and assumptions behind the model are discussed, starting with the advantages and disadvantages of using the gridded versus a vector approach. New methods devised to handle the gridded approach are discussed, including how to determine the grid cell resolution, the spacing between individual radials, and a detailed look at determining the spacing between individual points along a radial. A new method that uses a unique step size for each individual radial is described in detail. Other features covered are the earth's curvature, the inclusion of vegetation data, the visual acuity, and an elevation matrix form to help select a precise observer location. Finally, other closely related models that are based on the basic visibility model are discussed, including How High to Visibility, Radio Frequency Loss, Visibility Probability, Line-of-Sight for Obstacles, Aerial Detection, and Helicopter Approach Zones.

RADIUS: MODEL-BASED OPTIMIZATION

July 1995

Thomas M. Strat, Sr.
Lynn H. Quam, Sr.
Pascal V. Fua

SRI International

DACA76-92-C-0034

Keywords: Computer Vision, Aerial Image Analysis, RADIUS, Optimization, Snakes

The construction and use of 3-D models of military and industrial sites will allow revolutionary advances in the speed, confidence, and range of analytical techniques with which an Image Analyst (IA) develops and reports intelligence information. This SRI research project, in support of the RADIUS Program, seeks to increase the speed and accuracy with which site models can be constructed from current imagery by developing a new family of image understanding (IU) techniques, and by developing a novel way for an IA to employ them.

**SCALABLE PROCESSING FOR DISTRIBUTED SIMULATION
AND SCENE GENERATION
July 1995**

Brahm A. Rhodes
Steve D. Bronson

Onyx Sciences Corporation

DACA76-94-C-0007

Keywords: Massively Parallel Processing, Terrain Rendering, Computer Graphics, Visual Simulation

This report details the results of researching and evaluating massively parallel architectures and visualization techniques. The main focus of this project was to evaluate and determine the potential of parallel computing systems for visual simulation applications, such as distributed interactive simulation, scene generation, visualization and others. This report summarizes results of our performance tests; describes scenarios and architectures that exploit parallel processors for visual simulation applications; discusses the state of the parallel computing industry; and presents recommendations for further research and development. Furthermore, this document describes a prototype toolkit to explore various options for using parallel processors for visual simulation.

TEC-0066

AD B206 619L

**DEVELOPMENT OF A STATISTICAL METHOD FOR THREE-DIMENSIONAL
TERRAIN ELEVATION ERROR ANALYSIS, PHASE II
July 1995**

David J. Dermody
Gary M. Wrap

TRIFID Corporation

DACA76-92-C-0026

Keywords: Digital Terrain Elevation Data, DTED, DTM Accuracy, Error Propagation, Visibility

Digital Terrain Elevation Data (DTED) has been produced by the Defense Mapping Agency (DMA) since 1974 as one of two primary data components of the Digital Landmass System (DLMS) Data Base. Typically, the DoD user is not familiar with the error in the DTED because of the specification limitations, the materials used in DTED production, and the production processes employed in the generation of DTED. Also, the user may be unaware of existing and conceptual methodologies for the accuracy evaluation of DTED. This unawareness of DTED limitations may lead to critical errors in the tactical decision making process. This report examines the effect of these accuracy limitations through error propagation in five tactical applications: Radial Terrain Masked Area plots, Incoming Target Acquisition, Flight Line Masking, Cross-Country Mobility, and Volume Computation. To support this error propagation, techniques were developed to evaluate DTED in the absence of DMA accuracy data to determine the likely production method. The evaluation of several DTED cells was performed against a variety of control sources to provide artificial intelligence used to access DTED cells in the tactical applications.

TEC-0068

AD A302 505

**SPECTRAL SIGNATURES OF WETLANDS PLANTS (350-990nm)
August 1995**

John E. Anderson

Keywords: Wetlands, Reflectance, Spectral Signatures

Field spectral reflectance measurements (350-900nm) were collected on select coastal and freshwater wetland plant canopies during the 1994 growing season. In this report, the author catalogues the signatures obtained for tidal and non-tidal specimens. This is the first report in an overall compendium of wetland plant signatures. In addition, this reference includes algal biomass and soil signatures.

**PASSIVE RECOVERY OF SCENE GEOMETRY FOR
AN UNMANNED GROUND VEHICLE
September 1995**

Robert C. Bolles
Martin A. Fischler

SRI International

DACA76-92-C-0003

Keywords: Stereo Analysis, Motion Analysis, Unmanned Ground Vehicle, FLIR, Semantic Scene Sketch

The goal of this project was to develop techniques for constructing 3-D descriptions of outdoor scenes to support the navigational needs of an Unmanned Ground Vehicle (UGV), operating both during the day and at night. In this report we describe our progress in four areas: Stereo Evaluation—We performed an in-depth evaluation of three representative stereo techniques by analyzing the results on 49 stereo pairs; Stereo Sketch—We developed a high-level representation of an outdoor scene, which we call a “scene sketch,” that can describe the semantic, as well as geometric properties of a 3-D scene; Spatiotemporal Filtering—We developed a technique for increasing the resolution and robustness of passive range sensors by integrating stereo and motion analysis; FLIR Stereo—We demonstrated the effectiveness of stereo analysis applied to infrared data, which makes passive night driving possible.

**TASK-DRIVEN ACTIVE VISION FOR
SECURITY AND SURVEILLANCE
January 1996**

H. Keith Nishihara
Stanley J. Rosenschein
Phil Kahn
J. Brian Burns
Matthew Turk

Teleos Research

DACA76-93-C-0017

Keywords: Physical Security, Recognition, Figure-Ground, Real-Time Tracking

Teleos is developing and integrating active vision technology with intelligent, domain-specific control strategies to provide real-time visual detection, characterization, and tracking of objects in the security and surveillance domain. Work to date has focused on theoretical studies and experimentation in the areas of attentional mechanisms, figure-ground discrimination, recognition, and active sensor mechanisms to support visual surveillance. The primary research focus is on the detection and tracking of humans in a monitored area. This report describes new results in blob-based shape recognition; the use of oriented texture blobs for face-finding; and stereo-based real-time figure-ground discrimination techniques.

**GPS TIDES: A PROJECT TO DETERMINE TIDAL DATUMS WITH
THE GLOBAL POSITIONING SYSTEM
August 1995**

Stephen R. DeLoach

Keywords: Global Positioning System (GPS), OTF Ambiguity Resolution, Tidal Datums, Tide Gauges

The recent development of On-the-Fly (OTF) ambiguity resolution techniques with Global Positioning System (GPS) observations has created a powerful tool for the study of dynamic time series, such as tidal analysis or the study of water level heights. For this project a GPS receiver was successfully operated on board a Canadian Coast Guard navigation buoy. Ten days of data, at a one-second sampling interval, were collected at a station in the open waters of the Bay of Fundy, followed by 10 days from an inshore mooring. The buoy data were transmitted in real time to a reference station on shore where antenna heights were computed in real time. Subsequent processing reduced the 1-Hz antenna height series to a 15-minute water surface height series for comparison to two nearby "conventional" gauges. These were the Saint John Harbour permanent gauge and a temporary Socomar pressure gauge. Mean tide heights computed from the inshore data are all within 1 cm. The means, computed from the inshore series, differed by 20 cm between the buoy and the "conventional gauges," indicating a differential slope between the water surface and the ellipsoid. In addition to the water surface measurements, about 20 days of GPS data were collected from a static baseline to characterize the performance of the OTF GPS system, without the influence of a moving platform. From the 20 days of data, 97 percent is within 3 cm of truth, while the mean daily heights are about 0.3 cm below the truth. This project has demonstrated that the "GPS buoy" is a viable method of tidal datum determination and it should be possible to use the ellipsoid as the basis for water surface datums.

IFSAR DATA FOR AUTOMATED RAPID MAPPING—PHASE I SBIR
October 1995

Vexel Corporation

DACA76-95-C-0007

Keywords: Interferometric Synthetic Aperture Radar (IFSAR), Rapid Mapping Classification, Feature Extraction, Digital Elevation Model (DEM)

This report summarizes work in the area of feature-based classification of interferometric synthetic aperture radar (IFSAR) imagery. This work will support the Army's goal of doing "rapid mapping." The potential of the new airborne IFSAR mapping instrument designed, built, and operated by the Environmental Research Institute of Michigan (ERIM) also is evaluated. This IFSAR system is tasked with high-resolution mapping. The focus of the Phase I task was to use all three of these data sets to extract map elements. These elements include land-use polygons, elevation contours, hydrology networks, transportation networks, buildings, and other manmade structures. This report shows that the IFSAR data are suitable for distinguishing major categories of land use, such as urban areas, forests, fields, open water, and swamps. Major road networks also can be vectorized automatically from the data. A significant result is a new technique that was developed that enables extraction of the "bald earth" elevation from the IFSAR elevation provided. This allows further extraction of features on the "bald earth," such as buildings, electric power line towers, and tree stands. Example map products illustrating these results are provided in this report.

COMPUTER AUTOMATED IMAGE CLASSIFICATION
November 1995

K. O'Rourke

Pacific-Sierra Research Corporation

DACA76-95-C-0012

Keywords: Synthetic Aperture Radar, Digital Terrain Elevation, Map Reduction, Neural Networks, Drainage Systems, Automated Images

The primary objective of the research and development was to achieve classification and feature extraction from high-resolution digital terrain elevation (DTE) data and corresponding fine resolution SAR imagery generated from interferometric synthetic aperture radar (IFSAR) data. The report contains six sections. Section 1 contains a project summary that describes the objectives, approach, results, and conclusions of the Phase I project. Section 2 presents a discussion of future research and development recommended for a Phase II SBIR program. Section 3 presents details on the image data used for developing the image classification algorithms. Section 4 describes details of neural network (NN) algorithms investigated for image classification. Section 5 describes an image processing technique for extracting a specific feature type (water drainage systems) from high-resolution digital terrain elevation (DTE) data. Section 6 presents the technical results obtained during the Phase I project.

DIS TERRAIN DATA FORMAT STUDY
November 1995

Deb Herman
Scott Barrett
Tim Langevin
Kevin Trott
Audrey Copperwheat

PAR Government Systems Corporation

DACA76-90-D-0001

Keywords: Distributed Interactive Simulation, Synthetic Environments, Digital Topographic Data (DTD), Spatial Data Formats, Terrain

The purpose of this report is to provide descriptions and comparisons of existing and developing standard Digital Topographic Data (DTD) and Distributed Interactive Simulation (DIS) terrain data exchange formats in the context of general DIS community requirements for terrain data. An analysis of these formats was made to determine each format's key features and its ability to support the DIS community. Each format was examined relative to the support that it provides for each of the following key characteristics: metadata; topology, ranging from Level 0 (none) to Level 3 (full topology support); spatial organization and indexing; feature and attribute coding; text; composite features; integration and/or layering; multiple levels of detail; 3-D data; 3-D model behaviors; and, coordinate systems and datums. The results of this study identified key spatial data modeling and representation concepts provided by these formats which should be included in future synthetic environment data interchange standards.

TEC-0077

AD A303 485

REPRESENTATION, MODELING AND RECOGNITION OF OUTDOOR SCENES
January 1996

Martin A. Fischler
Robert C. Bolles

SRI International

DACA76-92-C-0008

Keywords: Machine Vision, Automated Scene Analysis, Object Recognition, Terrain Modeling

The goal of this project is to advance the state-of-the-art in scene interpretation for autonomous systems that operate in natural terrain. In particular, techniques are being developed for representing knowledge about complex cultural and natural environments so that a computer vision system can successfully plan, navigate, recognize and manipulate objects, and answer questions or make decisions relevant to this knowledge. The results to date include the development of new representations for rapidly modeling terrain from multiple images—including 3-D hexagonal surface meshes and “particle-based” 3-D modeling primitives that allow a robotic system to incrementally build a complete geometric model of its environment. We have also extended and improved our set of object recognition primitives to allow reliable labeling of such scene attributes and components as color, texture, shadows, and a variety of linear structures (skyline, ridgelines, roads, etc.). The most recent results are detailed in four published papers included as appendices to this report.

TEC-0078

AD A303 607

**IMAGE UNDERSTANDING ENVIRONMENT FOR ARPA-SUPPORTED
RESEARCH AND APPLICATIONS**
January 1996

Douglas Morgan

Booz, Allen and Hamilton, Inc.

DACA76-89-C-0023

Keywords: Image Understanding, Environments, Object-Oriented Specification

This report documents the design and development of a Vision Environment system and contributions to the design of the ARPA Image Understanding Environment (IUE). The primary contributions are to an object-oriented specification of a hierarchy of classes for image understanding applications. Analyses of implementation issues in both the C++ and Common Lisp languages also are presented.

**RESEARCH IN MODEL-BASED CHANGE DETECTION AND
SITE MODEL UPDATING
January 1996**

R. Nevatia

University of Southern California

DACA76-93-C-0014

Keywords: Change Detection, Fine Registration, Matching, Perceptual Grouping, Shadow Analysis Model Construction

Change detection is perhaps the most important task in the process of photo interpretation, and an ideal one to demonstrate the effectiveness of the site modeling exploitation (SME) approach that has been adopted for the RADIUS program. Change detection is a tedious task as it requires careful comparison of images (and their models) taken at different times under possible varying conditions. The task of change detection consists of comparing a new image of a site (or a collection of images), to the information contained in the folder for that site. The information in the site folder may consist of one or more previous images and results of previous analyses on these images. We believe that even partial automation of this task will greatly increase an analyst's productivity and possibly enhance the reliability of the results.

TEC-0080

AD A307 126

**EL NINO—ITS FAR-REACHING ENVIRONMENTAL EFFECTS ON ARMY
TACTICAL DECISION AIDS
March 1996**

John Neander

Keywords: El Nino, Tactical Decisions, Ocean Currents, Logistical Planning, Weather Patterns, Climate Change

El Nino. A series of benign changes in pressure and temperature over Darwin, Australia and Tahiti often results in significant changes in oceanographic and atmospheric patterns around the world. These, in turn, can produce short-term weather changes that impact vested interests of the United States on the world's political and military arenas. At the onset of an El Nino, the oceanographic changes are complemented by atmospheric changes that result in abrupt weather pattern reversals in a seasonal and a geographic context. The two weather extremes to consider from an El Nino event are droughts and floods. To know the likely implications of an El Nino event in advance will allow strategic and logistic planners to more accurately decide what type of weapons and support material will work best for the United States in the various world theaters.

**AN ASSESSMENT OF THE HORIZONTAL ACCURACY OF
INTERIM TERRAIN DATA
April 1996**

Louis Fatale
Jeffrey Messmore
James Ackeret

Keywords: Accuracy, Global Positioning System (GPS), Terrain Data, Geographic Information System (GIS)

Within the U.S. Army and throughout the private sector, the accuracy of Digital Topographic Data (DTD) is often taken for granted. Users assume terrain data to be accurate merely because of its digital nature. This report describes a study that was undertaken to determine the horizontal accuracy of Interim Terrain Data (ITD), a 1:50,000-scale terrain analysis data base. ITD is composed of vector features and associated attributes representing land cover characteristics. It is produced by the Defense Mapping Agency (DMA) and provided to the U.S. Army to support near-term requirements on an interim basis until more standardized data are available. Because of its interim nature, ITD may be digitized from hard-copy source ("carto-controlled") or produced solely from photography ("photo-controlled"). No definitive accuracy statement is provided with the data. This study was initiated in 1994 with the collection of ground coordinates for more than 400 selected ITD features. Each feature was located in the field using a Precise Lightweight Global Positioning System Receiver (PLGR) in the Precise Positioning Service (PPS) mode (10-meter horizontal accuracy). Universal Transverse Mercator (UTM) coordinates obtained from the PLGR were annotated for each feature. The UTM coordinates for coincident features in the ITD digital files were subsequently extracted by GIS query to compare statistically the digital data with the field data, calculate the offsets, and determine the horizontal accuracy of the ITD. The potential accuracy differences between the carto- and photo-controlled ITD and the variability of natural vs. man-made features also are discussed.

THE UMASS RADIUS PROJECT—YEAR 2
October 1996

Robert Collins
Allen Hanson
Edward Riseman

University of Massachusetts

DACA76-92-C-0041

Keywords: Building Extraction, Site Model Acquisition and Extension, Aerial Image Understanding, 3-D Scene Visualization

A set of image understanding (IU) algorithms for automated site model acquisition and extension are being developed at the University of Massachusetts. In 1995, a building extraction system was implemented to acquire flat roofed, rectilinear building models from multiple, monocular images. This system hypothesizes building rooftops from a single image, then searches for supporting evidence in other views and determines the precise 3-D shape and location of each building via multi-image triangulation. Projective mapping of image intensity information onto these polyhedral building models results in a realistic site model that can be rendered using virtual "fly-through" graphics. To perform model extension, a prior site model is registered to new images, and building model acquisition procedures are focused on previously unmodeled areas. In an operational scenario, this process would be repeated as new images become available, gradually accumulating evidence over time to make the site model data base more complete and accurate. Model-to-image registration techniques also are presented that can be used to automatically determine model-based local corrections to the resected camera parameters provided with each image.

TEC-0083

AD B215 801L

PERSONAL NAVIGATION AND REPORTING, PHASE II
April 1996

Robert W. Levi
Tom Judd

Point Research Corporation

DACA76-94-C-0005

Keywords: Navigation, Personal Navigation, Dead Reckoning Navigation

This report describes the development of a prototype Personal Navigation and Reporting System (PNRS). The purpose of the PNRS was to investigate and develop a self-contained navigation system for dismounted soldiers. The system would be based on a magnetic compass, altimeter, and a personal distance measuring device. Data from the navigation system would be used as a supplement to GPS position information. The project was achieved in two phases. The feasibility and general approach were developed in Phase I. Prototype hardware and software were developed and tested during Phase II.

THREE-DIMENSIONAL MODELING STATION, PHASE II
October 1996

Lei Zhang
Javier F. Maida
Gregory D. James

Mandex, Inc.

DACA76-93-C-0027

Keywords: Model Library, 3-D Modeling, Model Data Set, Computer Graphics, Graphics Work Station, Simulation

The objective of this Phase II SBIR project was to provide the U.S. Army Topographic Engineering Center (TEC) with a 3-D Modeling Station composed of hardware, software, and development tools, and to create and populate a data base with models of suitable features found in Defense Mapping Agency's (DMA) Interim Terrain Data (ITD) set, at an appropriate level of detail. A low-end DOS-based system and a high-end UNIX-based system were configured to meet the varied requirements of simulator data base development, and more than 160 3-D feature models were created using the modeling stations. These models represent terrain features, both natural and man-made, defined in the DMA's ITD. Models are available in AutoCAD DXF, IRIS Open Inventor (IV), and Wavefront OBJ formats. A relational data base was designed and created to store the model information, and serves as a standard model library. A DBMS system with the X-Window/Motif graphical user interface was developed to provide tools for model data manipulation and management. Dynamic model placement tools were developed for placing models into simulation scenes. Using these tools, the following three feature types can be placed: point, linear, and area.

**A STUDY OF ARMY REQUIREMENTS FOR MAPPING, CHARTING,
AND GEODESY/DIGITAL TOPOGRAPHIC DATA**

July 1996

Thomas E. Lee
Steven M. DiSilvio
Denise Hovanec, TEC

William L. Othling, Jr.
F. Leslie Speir

Science Applications International Corporation

DACA76-90-D-0002

Keywords: Digital Topographic Data, Terrain Elevation Data, Feature Data, Data Content, Data Resolution, Data Accuracy

The Defense Mapping Agency (DMA) is beginning production of the digital land combat products required by the U.S. Army. Requirements for these products were initially documented and provided to DMA in the 1984 "Army Digital Topographic Data Requirements" document. At the request of the Deputy Chief of Staff of the Army for Intelligence, the U.S. Army Topographic Engineering Center (TEC) completed another requirements study intended to revalidate previously stated requirements, and assess the ability of planned and current products to meet these requirements. This report documents new feature and attribute requirements and addresses scale and resolution requirements for the 58 Army users surveyed.

TEC-SR-6

AD A292 131

**A HISTORY UPDATE OF THE U.S. ARMY ENGINEER TOPOGRAPHIC
LABORATORIES, FORT BELVOIR, VIRGINIA, 1984-1988
August 1994**

Robert Hellman

Keywords: ETL History, Research and Development, Mapping, Surveying

This document presents the historical changes and growth of the U.S. Army Engineer Topographic Laboratories from 1984 to 1988. It also provides a general description of the research and development programs during this period.

TEC-SR-7

AD A307 127

**HANDBOOK FOR TRANSFORMATION OF DATUMS, PROJECTIONS, GRIDS
AND COMMON COORDINATE SYSTEMS
January 1996**

Frederick Gloeckler
Richard Joy
Justin Simpson
Daniel Specht

Keywords: Cartography, Datums, Projections, Geodesy, Coordinates

This document provides Army organizations and agencies with general guidance on selecting the appropriate methods for shifting between local geodetic datums and the World Geodetic System (WGS), and for converting Cartesian and map projection coordinates to and from geodetic coordinates. This guidance is provided to aid the Army community in selecting datum shift algorithms, in developing, selecting, and maintaining software using these algorithms, and in implementing this software to support operational units. Equations are furnished for map projections and datums commonly used within the Army, and references are provided for other, less commonly encountered, map projections and datums.

PAPERS

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ANDERSON, John, "Spectral Reflectance of Wetland Plants," National Interagency Workshop on Wetlands, 3-7 Apr 95, New Orleans, LA.

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Built-Up Area Feature Extraction: Final Report	TEC-0016	1991
Camera Calibration Study		no date
Capabilities of Remote Sensors to Determine Environmental Information for Combat	ETL-0081	1976
Cartographic Application of Conflex I	AD 882 789L	1964
Cartographic Design Standards — A Preliminary Investigation		1967
Cartographic Drafting Methods and Equipment	1305-TR	1953
Cartographic Drafting Methods and Equipment (Plastic Scribing Process) Second Interim Report	1339-TR	1954
Cartographic Electron Beam Recorder (EBR) System	ETL-0111	1977
Cartographic Electron Beam Scanner Design Study	ETL-0257	1981
Cartographic Scanner Plotter	ETL-CR-72-12	1972
Change Detector Maintenance Instructions		1966
Change Detector Operation Manual		1965
Change Detector Studies		1961
Characterization and Optimization of an Electro-Optic Imaging Device for Real-Time Map Profiling	ETL-CR-74-18	1974
Characterization of the PROM for Coherent Optical Processing Applications	ETL-0053	1976
Charging Equipment, Mobile (CEM)	ETL-0089	1976
Chemical Array Studies	ETL-0130	1977
Circularly Polarized Measurements of Radar Backscatter from Terrain	ETL-0199	1980
Circularly Polarized Measurements of Radar Backscatter from Terrain and Snow Covered Terrain	ETL-0234	1980
Circumpolar Method for Determining Azimuth	ETL-0317	1983
Classification and World Distribution of Vegetation Relative to V/STOL Aircraft Operations	ETL-SR-74-4	1973
Classification of Cartographic Features Through Walsh Transforms	ETL-0290	1982
Classification of Metamorphic Rocks and Their Applications to Air Photo Interpretation Procedures, The	ETL-0341	1983
Classification of Selected Radar Imagery Patterns Using a Binary Tree Classifier	ETL-0442	1986
Climatic Information for Application in Designing and Testing U.S. Army Materiel	ETL-0474	1987
CMU (Carnegie-Mellon University) Strategic Computing Vision Project Report: 1984 to 1985	ETL-0466	1987

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Coated Paper and Developer for Continuous Tone Electrophotography	AD 674 241	1968
Cold Weather Testing of 10-Second Direction Theodolite, 1-Minute Direction Theodolite (Foreign Model), Astronomical Attachment, and Winterization Kit	1288-TR	1953
Color Contact Printer Mark III	ETL-ETR-70-9	1970
Color Ink-Jet Demonstration Program	ETL-0196	1979
Color Orthophotomaps	ETL-ETR-72-2	1972
Color Separation System Evaluation	AD 672 078	1968
Combination Map Reproduction Van Body	1536-TR	1958
Combined Engineering and Service Tests of the Copy and Supply Van Section of the Motorized Photomapping Train	1444-TR	1956
Combined Engineering and Service Tests of the Map Revision Van Section of the Motorized Photomapping Train	1447-TR	1956
Combined Engineering and Service Tests of the Multiplex Van Section of the Motorized Photomapping Train	1520-TR	1958
Combined Engineering and Service Tests of the Photomapping Van Section of the Motorized Photomapping Train	1428-TR	1955
Combined Engineering and Service Tests of the Rectifier Van Section of the Motorized Photomapping Train	1544-TR	1958
Comparative Aerotriangulation Tests of the Multiplex Kelsh Plotter, Stereoplanigraph, Wild Autograph Model A-5, and Wild Stereoplotter Model A-6	1349-TR	1954
Comparative Study of Photography for Soils and Terrain Data	38-TR	1968
Comparison of Air Photo Landform Units to Statistically Defined Groups of Tors in Dartmoor, Southwest England	TEC-0001	1992
Comparison of Air Photo Lineations and Joint Patterns, Dartmoor, Southwest England	TEC-0006	1992
Comparison of Soils from Twentynine Palms, CA and Saudi Arabia, A	ETL-0583	1991
Comprehensive Summary of Project Trend	ETL-0041	1975
Computer-Assisted Likely Minesite Prediction Model and Estimated Electromagnetic and Thermal Soil Properties	ETL-0391	1985
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Computer for Army Artillery Inertial Survey System (GEISHA)	AD 814 052	1963
Computer Generation of Fractal Terrains	ETL-0504	1988
Computer Program to Simulate Scenario Functions	ETL-0025	1975
Computer Strategy for Detecting Line Features on Simulated Binary Arrays in Support of Radar Feature Extraction	ETL-0478	1988
Computing a Line-of-Sight Using Digital Image Matching and Analytical Photogrammetry	ETL-0027	1975
Consensus Theory in Expert Systems: An Adaptive Inference Framework and Application to Image Understanding	ETL-0524	1988
Concept Development of Automated Image Analysis	ETL-0194	1979
Concept Development of Automatic Instrumentation for Monitoring Movement of Dams	ETL-0187	1979
Concept for an Ultraprecise Geodetic Baseline	RN-24	1967
Conifer Tree Influence on Digital Terrain Elevation Data (DTED): A Case Study at Dulles International Airport	TEC-0038	1993
CONPLOT I — A Contour Generating Program	ETL-CR-70-2	1970
CONPLOT II — A Contour Generating Program	ETL-CR-71-1	1971
CONRAD — A Program to Contour Radar Data	ETL-CR-73-20	1973
Continuous-Tone Electrophotography	AD 673 881	1968
Contour Digitizing and Tagging Software (CONTAGRID)	ETL-0228	1980
Contour-to-Grid Interpolation with Nonlinear Finite Elements: A Feasibility Study	ETL-0472	1987
Contribution to the Philosophy of Climatic Design Limits for Army Materiel: Extreme Hot-Desert Conditions	ETL-TR-72-5	1972
Control Unit for Army Artillery Inertial Survey System (GEISHA)	AD 814 068	1968
Controlled Color for Contact Printing Aerial Imagery	ETL-TR-72-4	1972
Conversion of the CALAP Program from FORTRAN to DUCK. Final Report	ETL-0419	1986
Cooperative Autonomous Agents Testbed - First Annual Report	ETL-0571	1990
Cooperative Autonomous Agents Testbed - Second Annual Report	TEC-0051	1993
Coordinate Measurement Research: Basic and Applied Experiments with the Negative-Reticule Concept	ETL-CR-72-14	1972
Corona Study Relevant to Electrostatic Printing Process	ETL-CR-71-22	1971

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Corps of Engineers Maintenance Package for Inertial Survey Equipment	AD 847 498	1963
Correlation of Noisy Images	ETL-0230	1980
Cultural Data Base Implementation Study and Computer-Aided Scene Modeling System Users Manual	ETL-0380	1984
Cumulative Probability Tables for Testing Consensus in Ranking Experiments	ETL-0418	1986
Data Base Sizing Methodology Applied to the Army Terrain Information System (ARTINS)	ETL-0150	1978
Data Integrity Factors Affecting the Construction of the Mapping, Charting, and Geodesy Data Base	ETL-0357	1983
Data Weighing Analysis	AD 672 101	1968
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Defense Mapping Agency Advanced Raster-to-Vector Benchmark Testing	ETL-0420	1986
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Delta Pulse Code Modulation Compression Relative to Stereo Image Matching	ETL-0157	1978
Demonstration and Evaluation of the Utilization of Side-Looking Airborne Radar for Military Terrain Analysis	ETL-0023	1975
Derivation and Potential of New Filter Equations for Numerical Weather Prediction	ETL-RN-71-3	1971
Description of Instrumentation Data Analysis and Reduction for an Atmospheric Seeing Monitor	AD 701 124	1969
Design and Analysis of a High-Production Mini- Computer System for Regridding Digital Terrain Elevation Matrices	ETL-0240	1980
Design and Development of a Position and Azimuth Determining System (PADS)	ETL-CR-71-18	1971
Design and Development of an Advanced Electron Beam Control System	ETL-0032	1975
Design and Development of Power Package for Surveying Instrument: Azimuth, Gyro, Lightweight	ETL-CR-71-5A	1971

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Design and Fabrication of a 70 Millimeter Inter- ference Imaging System	ETL-CR-71-8	1971
Design and Fabrication of an Experimental Multiband Camera	ETL-CR-71-28	1971
Design and Feasibility Study of an Off-Line Digital Orthoprinter for Field Use	ETL-0149	1978
Design and Feasibility Study of HOC as a Van Mounted Stereo Model Digitizer	ETL-0109	1977
Design, Fabrication, and Test of a Position and Azimuth Determining System (PADS)	ETL-CR-73-6	1973
Design Issues in Video Disc Map Display	ETL-0362	1984
Design, Modification, Fabrication, and Test of a Prototype Miniaturized North Reference Unit (MINRU)	ETL-0276	1979
Design of a Laser Experiment for the Verification of the Inverse Scattering Theory	AD 463 012L	1965
Design of a Map Update Capability for Engineer Topographic Units	ETL-0107	1977
Design of an Experimental Program for Evaluation of LBR Systems	ETL-0182	1979
Design of Engineering Test Model, Topographic Data System		
Volume 1	AD 270 216L	1961
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Design Studies and Prototype Model Development of a Small North Orienting Device (Miniaturized Gyrocompass)	ETL-CR-70-4	1970
Design Study of a Large Format Printer (LFP) Desk Model Fotosetter Photo-Lettering Machine 1953	ETL-0368 1329-TR	1984
Detecting Line-Road and Road-Intersection Patterns at Various Angles	ETL-0274	1981
Determination of Height Differences from Gravity and Gravity Gradients	ETL-71-CR-10	1971
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Determinations of Direct and Inverse Azimuths, Zenith Distance, Hour Angle, Declination and Distance Between Two Points on Normal Sections	RN-19	1967
Determining an Azimuth with a Gyrotheodolite	ETL-0440	1986
Determining the Translation of a Rigidly Moving Surface, Without Correspondence	ETL-0475	1986
Developing a Data Base for Predicting Soviet Tactical Behavior	ETL-0015	1975
Development of a High Precision Capability for Monitoring Structural Movements of Locks and Dams	ETL-0121	1977
Development of an Integrated Mobile Robot System at Carnegie Mellon University	ETL-0546	1989
Development of an Integrated Mobile Robot System at Carnegie Mellon University	ETL-0565	1990
Development of a Prototype Family of Military Geographic Intelligence Products to Support Airmobile Operations	ETL-ETR-70-7	1970
Development of a Small North Orienting Device	AD 869 896L	1970
Development of a Statistical Method for Three Dimensional Terrain Elevation Error Analysis	TEC-0030	1991
Development of a Terrain Profile Recorder Image Point Transfer Instrument	AD 649 830	1967
Development of Automatic Names Placement Software	ETL-0484	1987
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Development of an Experimental Family of Military Geographic Intelligence (MGI) Products to Support Battlefield Sensor Activities	ETL-TR-72-3	1972
Development of an Integrated Mobile Robot System at Carnegie Mellon University	ETL-0565	1990
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TITLE	REPORT NO.	YEAR
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Development of Computer Vision Techniques for Automatic Feature Extraction	ETL-0451	1987
Development of Descriptor Sets for the Unambiguous Characterization of Geographic Features on SAR Imagery	ETL-0369	1984
Development of Electronic Control of a Superconducting Gravity Gradiometer	ETL-0397	1985
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Development of Finite Element Models for the Earth's Gravity Field Phase I: Macro Gravity Model for Satellite Orbit Integration	ETL-0096	1977
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Development of Height Finder Oblique, Topographic	1383-TR	1954
Development of High Speed CRT Print Head Systems for Cartographic Applications	ETL-0213	1980
Development of Improved Area Correlation Techniques	ETL-CR-73-19	1973
Development of Lightweight Long-Range Survey System (LRSS)	AD 477 042	1965
Development of Spherical Map Sections and Transparent Conforming Overlays	1440-TR	1956
Development, Service Tests, and Production Model Tests, Autofocusing Rectifier	1307-TR	1953
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Developmental Optical Correlator	ETL-0033	1975
DFAD PLUS System Development	TEC-0031	1992
Digest of High Temperature Storage Literature	ETL-0152	1978
Digital Automatic Map Compilation System	AD 285 258	1962
Digital Cartographic Study and Benchmark	ETL-0168	1978
Digital Cartographic Study and Benchmark — First Interim Technical Report	ETL-0090	1975
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Digital Image Manipulation and Enhancement System (DIMES) User's Handbook	ETL-CR-73-7	1973
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Digital Mapping System Concepts Study	ETL-CR-71-26	1971
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Digital Multicolor Recorders and Scanner The Technology and the Equipment	ETL-0551	1989
Digital Planimetric Compiler	ETL-ETR-72-1	1972
Digital Pre-Press System Design Study	ETL-0339	1983
Digital Radar Restitution	AD 448 230L	1964
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Digital Simulation of a Radar Image of Pisgah Crater Test Site, California	ETL-0019	1975
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Digital Terrain Elevation Data (DTED) Resolution and Requirements Study: Phase 2 Report	TEC-0035	1993
Digital Terrain Elevation Data Resolution and Requirements Study - Interim Report	ETL-SR-6	1990
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Direct Digital Color Proofing Technology Overview	ETL-0351	1984
Direct Electronic Transforms for Feature Extraction	ETL-0139	1978
Discrete Scattering Approach to Vegetation Modeling	ETL-0215	1980
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Discrimination of Water from Shadow Regions on Radar Imagery Using Computer Vision Techniques	ETL-0404	1985
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Edge Detection Experiment Using the MARR Operator, An	ETL-0435	1986
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Electronic Survey Equipment and Tests	AD-264 454	1960
Electro-Optical Image Processing with an Image Storage Tube	AD A836 685	1968
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Electrostatic Paper and Toner Development		1969

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Elevation Data Compaction by Polynomial Modeling	ETL-0140	1978
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Emergency Target Location Function	21-TR	1965
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Engineer Tests of 2.5 x Reduction Printer	ETL-ETR-74-7	1975
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Engineering Tests of Opaque Cartographic Bases	1290-TR	1953
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Engineering Tests of the Cartographic Grid Ruler	1486-TR	1957
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Engineering Tests of Two Printer-Developers, Ammonia Process, 24 Inch	1292-TR	1953
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2nd Interim Report	AD 461 100L	1965
3rd Interim Report	AD 477 474L	1965
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Hourly and Daily Precipitation Frequencies for the United States	ETL-0498	1988
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