

DIGITAL TERRAIN MODELLING

TERRAIN VISUALISATION AND EXPLOITATION FROM LASER-SCAN.



Laser-Scan provides a wide range of software packages for creating, manipulating, editing and displaying map data. A number of these packages in the DTM suite enable the conversion of two dimensional digital maps with their associated height information into the third dimension. This 3D information can then be used in a number of ways, from use in flight simulator displays to the planning of geological surveys and highway or radar siting.

Stored in a grid matrix (raster) format, this data can include digital terrain models, raster scanned images, or other pixel data (satellite imagery).

The DTM suite of software comes in a number of packages capable of both the 2D – to – 3D conversion and its subsequent exploitation. The DTM packages all run on standard DEC, VAX or VAXstation computers and are fully compatible with other Laser-Scan mapping software products.

In brief, the packages include the following.

MATRIX – This package allows you to organise the DTM files and perform basic, yet essential functions such as data merging, clipping, etc. There's even a library of software routines to enable the linking of

DTM files with your own applications software.

DTMPREPARE – A package providing many useful facilities for automatic and interactive checking of the input data to ensure that it is consistent and complete.

DTMCREATE – Creates the Digital Terrain Models using triangulation techniques. Once in grid format, the data can then be easily re-contoured if desired.

TVES – Powerful software to visualise and exploit the DTM's once created. Facilities are provided to integrate raster and vector data and use 3D information to the full. Techniques such as line-of-sight, hill shading, slopes, and direction maps are all possible.

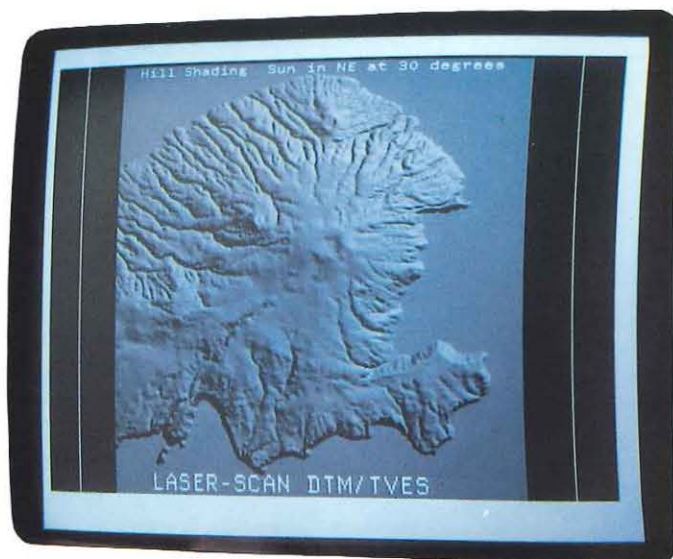
And once you have Digital Terrain Models you can use the information in a number of ways. The potential applications are almost limitless. However, in the fields of communication, defence, construction, surveying, geology and map making, DTM is indispensable.

Powerful, fast and versatile, Laser-Scan's DTM utilities lead the industry in effective terrain modelling software.

Laser-Scan

Laser-Scan Laboratories Ltd. Cambridge Science Park, Milton Road, Cambridge, CB4 4FY
Tel: 0223 315414 Telex: 817346 Fax: 0223 314044
Laser-Scan is a member of The Imtec Group Plc.

TECHNICAL SPECIFICATIONS



Simulated hill shading

DTMPREPARE is a package for the preparation of vector data with elevation attributes for conversion to a matrix digital terrain model (DTM). Command files can be generated to optimise the editing of the input vector data. Programs include:

I3D

A utility to check and height rivers and ridgelines for DTM creation. Rivers (and ridges) can be intersected with digitised contours to produce 3D strings, which dramatically improves the accuracy and quality of the terrain model. This powerful software also checks that rivers flow down-hill.

ITCHECK

Validates input data by checking for terrain height and shape inconsistencies, for example:

- Contours and spot heights incorrectly labelled
- Unclosed contour loops
- Contours that touch or cross

DTMCREATE is a package which generates grid DTM data from 3D vector data. This is carried out in several stages allowing flexible user interaction if necessary.

Programs include:

TRIANG

Performs a Delaunay triangulation on the input vector data files. This powerful method creates the best possible representation of the terrain. Facilities are available to constrain the triangulation for complex geomorphological applications. High quality DTM edge

matching is ensured.

TRIDER

Generates slope derivatives from the triangulated data.

TRIGRID

Generates a grid DTM from the triangulated slope data. User options include specification of grid cell dimensions and smoothing algorithm. This utility may be run several times to create the optimal terrain appearance from the triangulated data.

TRIEDIT

Allows the editing of triangulated data without reverting to the source vector data. Single or multiple vertices can be deleted or edited and single points or strings can be input, such as from a map registered to a digitising table. Fast recontouring can be performed for visual validation. Heighted triangle facets may be output as vector features for use in sophisticated visualisation applications.

TVES

(Terrain Visualisation and Exploitation Software) is a large and sophisticated package for the display, manipulation and editing of grid data, such as digital terrain models, land-use maps and satellite imagery. Programs include:

I2GRID

Converts data stored in the Laser-Scan Internal Feature Format (IFF) vectornotation into Digital Terrain Image notation (DTI) grid data. This is used, for example, to generate a grid land-use map from the vector polygon boundaries.

ROVER

Is a powerful display and edit utility. DTI files (including satellite imagery) can be displayed, roamed over, zoomed, rotated and sub-sectioned. Up to 4 files may be handled and displayed simultaneously on the graphics workstation. Vector data can be overlaid on the grid imagery, and new features can be vector digitised. Grid file editing facilities include single point, line and area editing using interpolation algorithms.

COVER

Is used with digital terrain model data to determine line-of-sight. Up to 8 observers can be specified with full control over position and field of view. Options include compensation for the height of surface features (woodland, buildings), earth curvature and atmospheric refraction.

SLOPES

Generates slope or aspect information from digital

terrain model data. Slopes and aspect can be specified with user defined gradients and angular steps. Displays can be annotated. Slope and aspect data can be combined to produce a shaded overlay with user defined light source position and elevation. Different ground reflectance algorithms are available.

DTICONTOUR

Is used to produce a vector contour map from grid digital terrain model data. Full cartographic facilities are available, such as for contour smoothing, labelling and feature coding. DTICONTOUR may be used, for example, for contour validation (after DTM processing) or for changing contour interval.

PROFILE

Creates terrain profiles of a DTM. This can optionally take into account a surface clutter file, for instance buildings, woodlands etc.

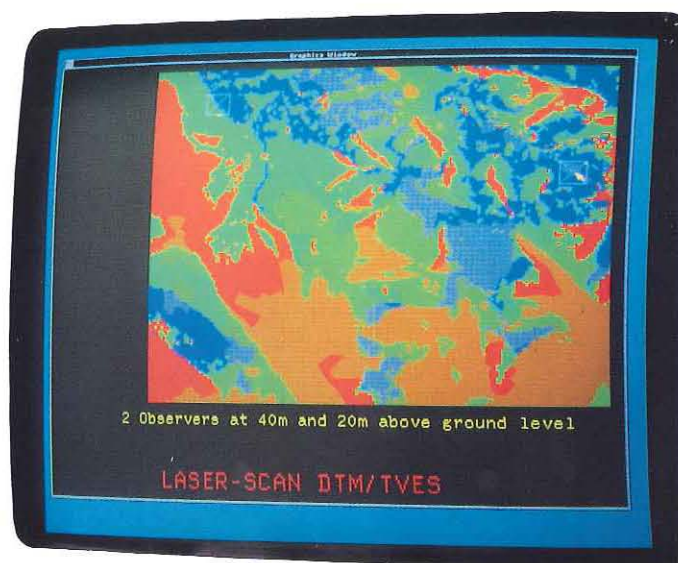
VECTORISE

Creates a vector data file of boundary lines between areas from a grid DTI file, for example, to create a vector polygon map from a land-use grid file, slope map or satellite image. The user can specify pixel value ranges and smoothing of the boundary lines.

MATRIX package contains a wide range of utilities for handling grid-based DTI format data. Examples include:

DTICOMBINE

Is used for combining matrix files (arithmetic operators allow overlay and difference operations), such as for



Line-of-sight for 2 observers

polygon overlay.

DTIEDIT

Allows editing of a matrix file using a VT100 compatible terminal.

DTIROTATE

Is used to rotate files and shift the origin.

DTITRANS

Enables transformation of a matrix file to a new map projection, resampling to a new grid interval, and satellite image geometric correction.

DTITILE

Allows the merging of multiple DTI files.

DTIVIEW

Is used for display of DTM elevation data as 3D perspective or isometric views. Options allow selection of the direction, height and distance of the viewing position, and vertical and horizontal exaggeration. 3D vector data such as roads and rivers can be overlaid on the terrain model.

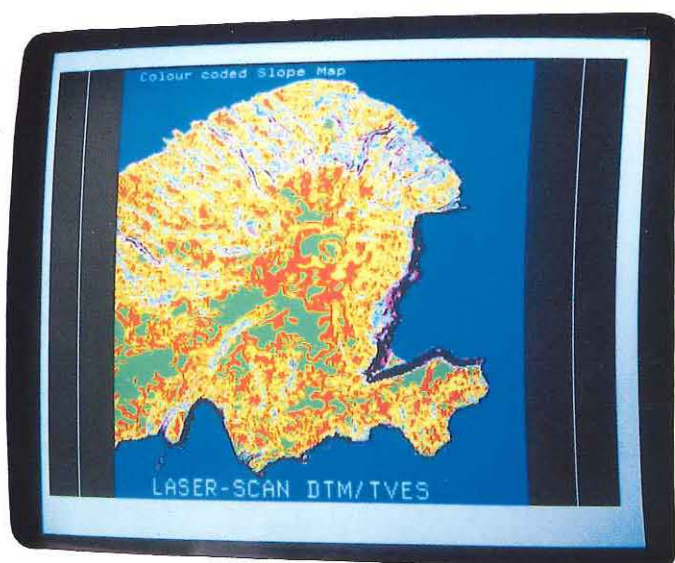
DTIILIB

Is a library of programming functions, it is provided to give the applications programmer facilities to read and write DTI files and manipulate the header information.

ADDITIONAL PACKAGES

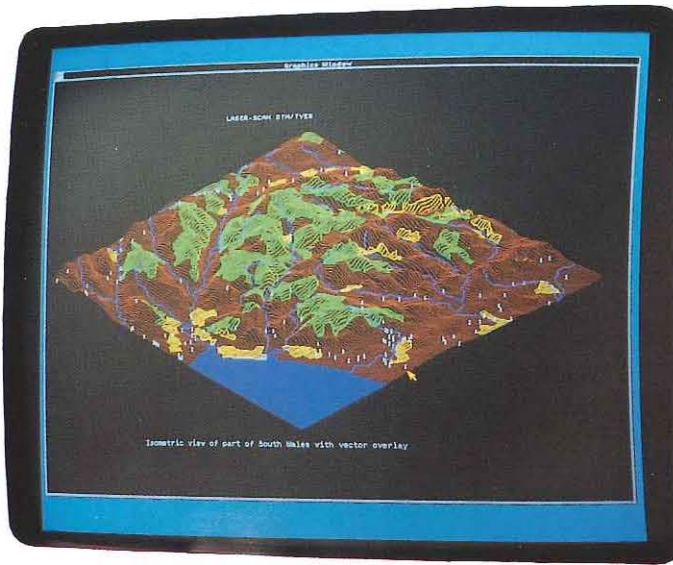
IMAGEPROCESS includes utilities for reading satellite imagery stored on computer compatible tapes and utilities for spatial filter operations.

DTMCONVERT contains utilities for the conversion of Laser-Scan DTI format files to and from external



Colour coded slopes map

TECHNICAL SPECIFICATIONS



Isometric profile with culture overlaid

formats, such as NATO DTED, OS NTF and I2S S500.

APPLICATIONS OF DIGITAL TERRAIN IMAGE DATA

Topographic mapping. Digital terrain models are widely used in the field of topographic mapping replacing or in conjunction with vector contour lines.

GIS/raster processing. Many forms of geographic data are stored as matrix files – land-use and geological maps for instance. These can be generated, manipulated, edited and output in hard copy format using the DTI processing functions described here. GIS tools are available for combining vector and raster data. Radio propagation analysis can be performed with the file merging, and terrain profile and intervisibility functions.

Satellite imagery can be displayed, enhanced, geometrically corrected and used to extract vector data, without the need to use specialised image processing hardware.

SYSTEM BENEFITS

- Flexible handling of grid data – processing of whole or part files, co-ordinate units changes, choices of display colour, default settings for most operations
- Sophisticated vector handling facilities – registration of grid image data to a digitising table, display of vector data files with full control over feature code and attribute data, vector data generation in a structured 'link-node' format
- Annotation of grid images with vector data, text and areal features (pattern)
- Full vector to raster and raster to vector conversion

facilities for contour maps and polygon maps

Display of superimposed raster and vector files, both in 2D and 3D (perspective and isometric)

Combination of matrix files allowing different factors to be weighted and the overall effect to be assessed

Generation of command files where appropriate to automatically drive the user to features requiring interaction

Complete compatibility with all other Laser-Scan vector handling facilities

Data structures ensure the most efficient possible grid data processing

Interactive help facilities available for all utilities

All Laser-Scan DTI processing utilities run on any DEC VAX computer. An 8 bit colour graphics display is required. This may be a DEC VAXstation display or another Laser-Scan supported display.

PACKAGE CONFIGURATION

Laser-Scan provide a large number of matrix and DTM processing utilities. These can be configured in a number of ways to suit customer needs. Please contact Laser-Scan to discuss individual requirements.

LASER-SCAN'S MAPPING ENVIRONMENT

The grid on format data is fully compatible with the Laser-Scan mapping environment. All of these facilities are offered on the same standard VAXstation to provide a single workstation solution to map data manipulation. Laser-Scan also have comprehensive facilities for vector data manipulation. Vector processing includes facilities for data capture, editing, structuring, plotting and format conversion. A range of GIS tools are available for interrogating vector, raster and attribute data, and for combining and evaluating these data sources.

Laser-Scan systems all operate on a stand-alone VAXstation or as part of a wider network or Local Area VAX Cluster (LAVc), optionally including a powerful processing node for rapid batch processing.

MAINTENANCE AND SUPPORT

Founded in 1969, Laser-Scan is an established world leader in digital mapping and vector map data capture. Matrix file manipulation and exploitation complement and enhance the vector processing capabilities and an on-going programme of research and development is continuing with refinements and extensions to current functionality. Laser-Scan software operates on standard DEC computers which are backed by Digital's worldwide service organisation.

Laser-Scan