

3DM Analyst

Focussing on the Future

Mining Analysis Software



The ADAM 3DM Analyst technology is designed for rapid extraction of accurate three-dimensional data from images taken with modern digital cameras.

The KEY ADVANTAGES of the 3DM Analyst software include:

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INTRODUCTION

3DM Analyst

The 3DM Analyst is a stand-alone, rapid data extraction program for use with digital imagery. The software uses pairs of overlapping or convergent aerial or terrestrial digital images that can be obtained either from digital cameras or scanned images.

The software offers advanced functionality for model orientations, using combinations of targets and camera stations and also allows the use of natural image points as additional input to enhance orientation.

Technical features/points

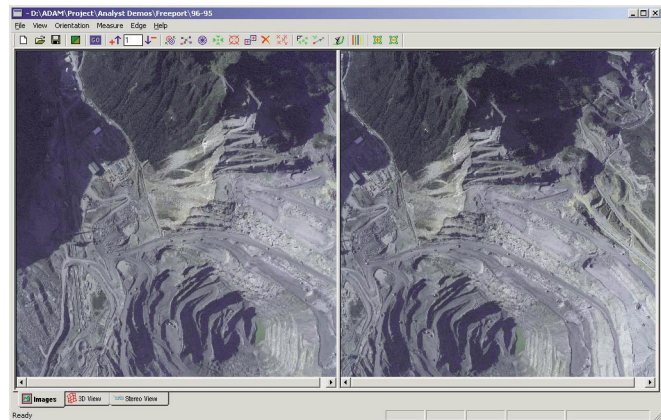
- Auto feature correlation for Break-line and other 3D line insertion functions.
- Unlimited Feature definition capability.
- Line or vector point editing by drag and drop.
- Auto Contour or sections generation with graphically assisted selection tools.
- DXF outputs of DTM points and triangles and all Poly-line data.
- DXF input is also supported.
- Stereo viewing of vector and raster data using Stereographics Z screen with polarised glasses / CrystalEyes workstation or Anaglyph.
- Toggle Auto ground tracking cursor in stereo viewing mode.
- 3D Poly-line measurement using 2 button mouse.
- All functionality and outputs except stereo viewing can be achieved on current model PCs without any other specialised hardware.
- Automatic DTM generation of user controlled density .
- 3D viewing using 2 button mouse for full control of position,
- Zoom and rotation of single or multiple models.
- 3D display options include DTM triangles plus any of the following,
 - DTM points alone,
 - DTM points with texture overlay,
 - DTM points with texture overlay and contours or sections.
- On screen edit of unwanted areas of DTM or in-fill any areas of light coverage.
- Image zoom, cursor position and rotation control is achieved using a standard 2 button mouse.
- Data insertion and extraction include specialised features for 3D line and point editing in 2D single screen digitising visual mode without special hardware.

RAPID AUTOMATIC DTM CREATION

Creating a DTM automatically with the 3DM Analyst is very simple and straightforward. In less than 10 minutes you can transform raw digital images into a dense, accurate DTM:

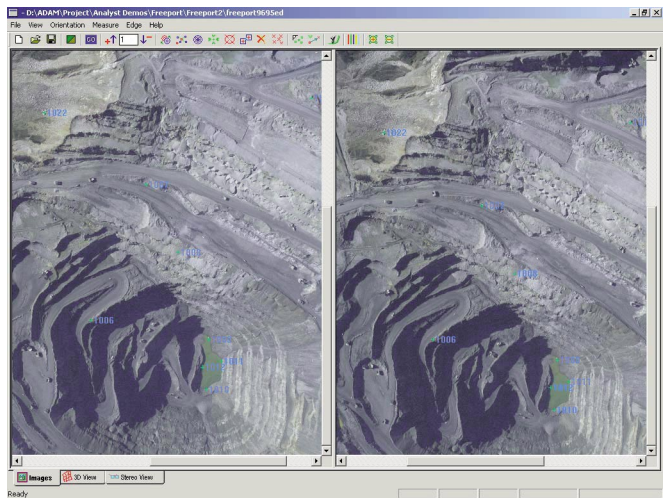
Step 1. Load raw images into the system

- Image formats supported: TIFF, JPEG, BMP, PNG, PCX, TGA

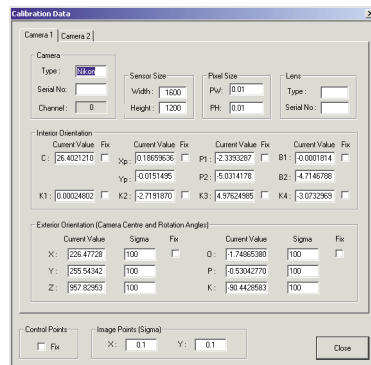


Step 2. Digitise control points (software assisted)

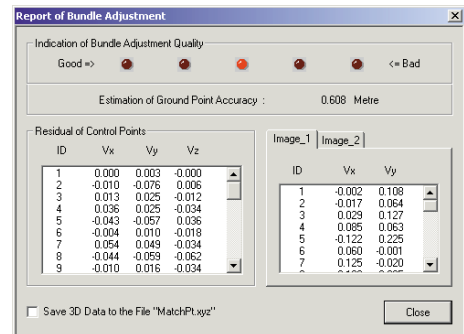
- Target centroiding for circular targets accurate to 1/10 of a pixel
- Least squares matching for other control and relative only points, accurate to 1/3 of a pixel
- Drive back feature for automatic target location



Step 3. Perform exterior orientation



Camera calibration/orientation data display

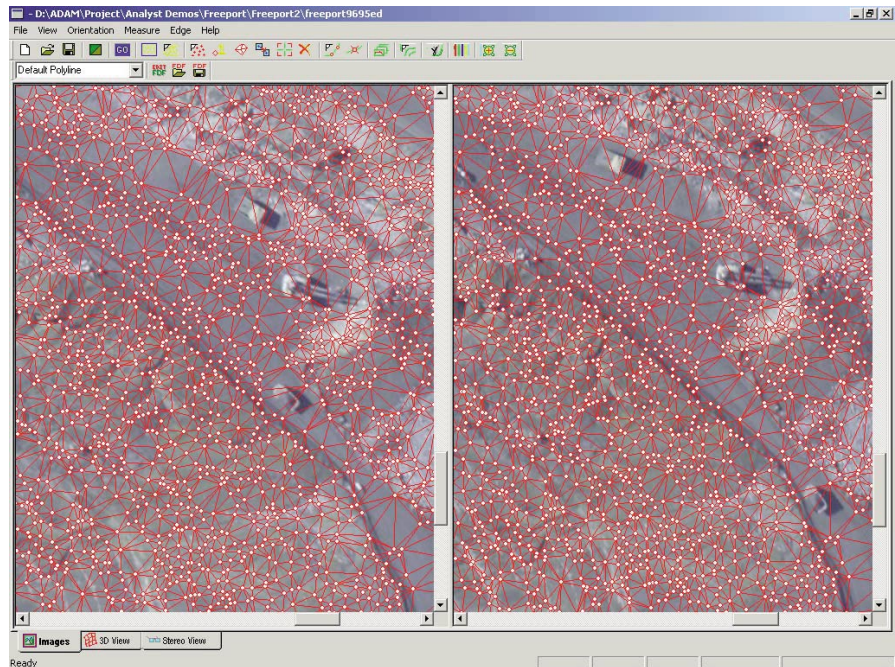


Exterior orientation residuals

Step 4. DTM Generation

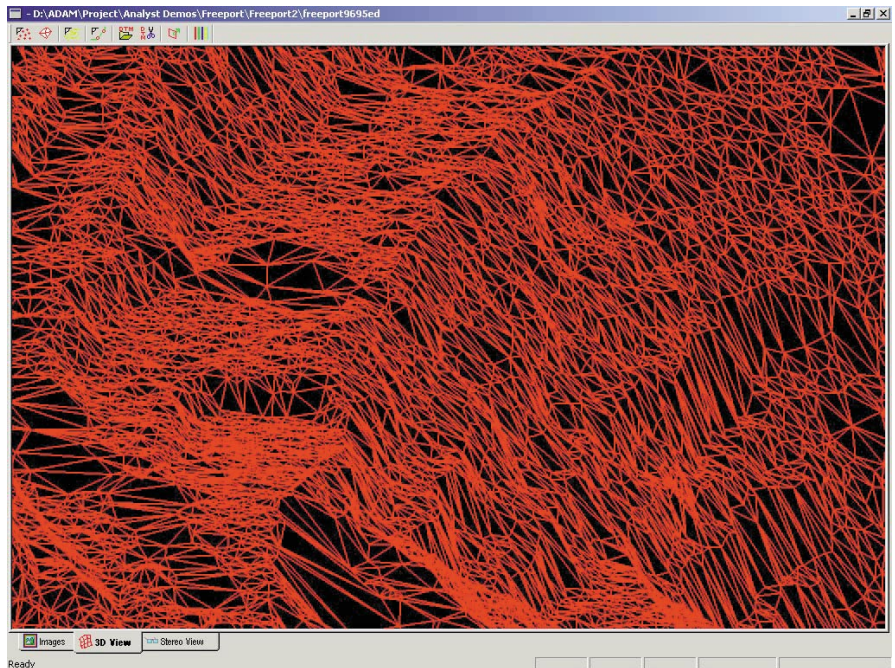
The typical model set-up time is less than five minutes. Once complete, a DTM can be generated fully automatically with the click of a button:

- Automatically generated DTM points are accurate up to 1/3 of a pixel



DTM points and triangles

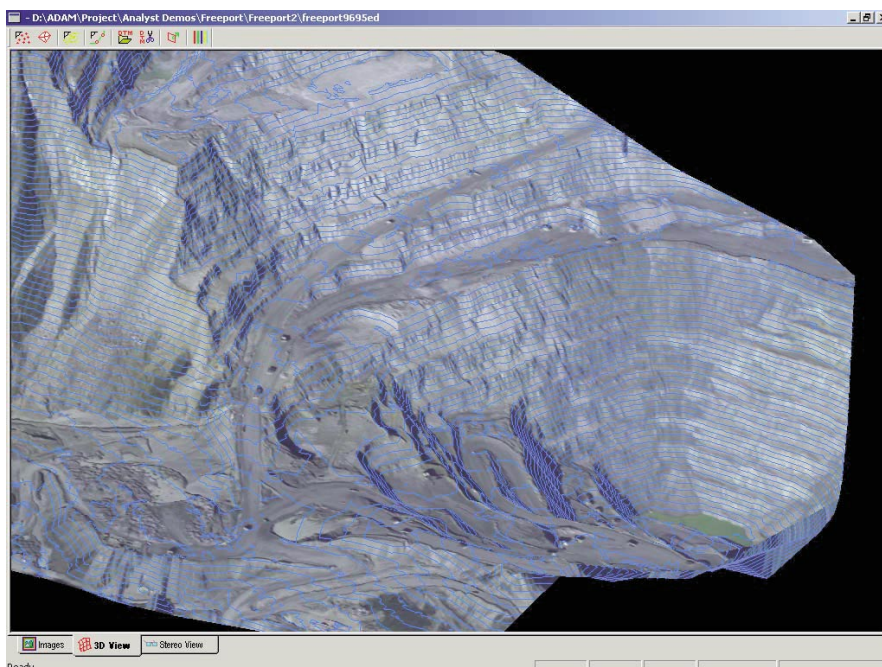
- DTM points are generated at up to 180 points per second. (66,000 points were generated in 6 minutes on a 1.4GHz PC with the sample images shown.)



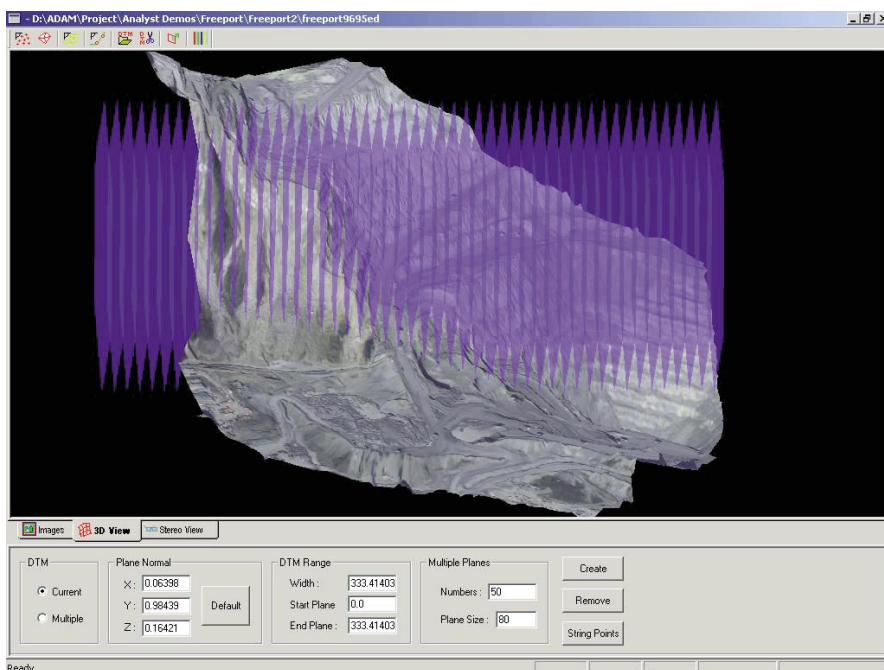
A section of DTM Mesh

Step 5. Process data

Once the DTM has been generated, a range of data processing and exporting options are available:

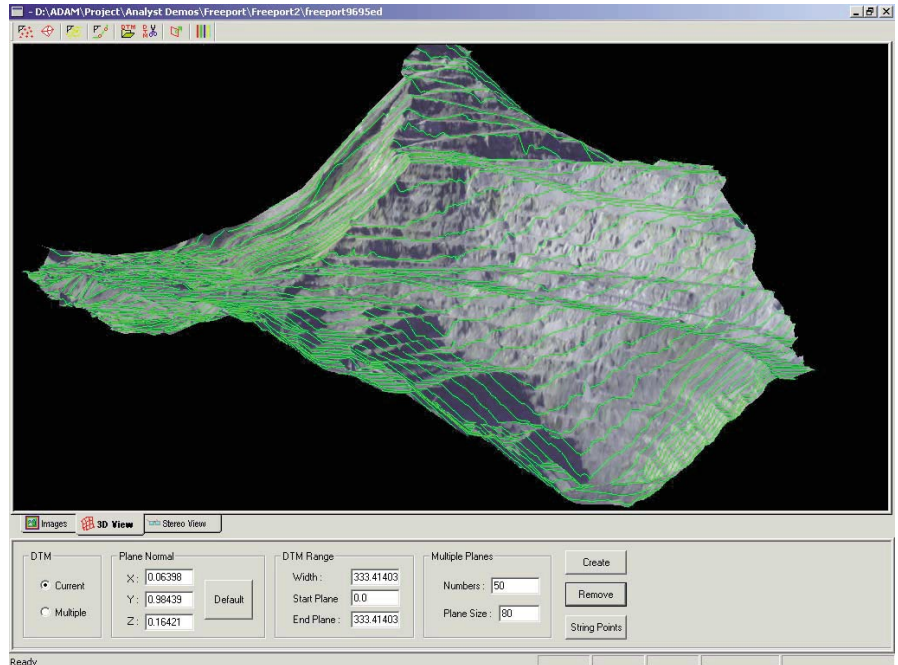


Automatically generated contours



Setting up cross-section generation

Data can be exported to other packages (e.g. Autocad via DXF format)



Cross-sections for export to Autocad

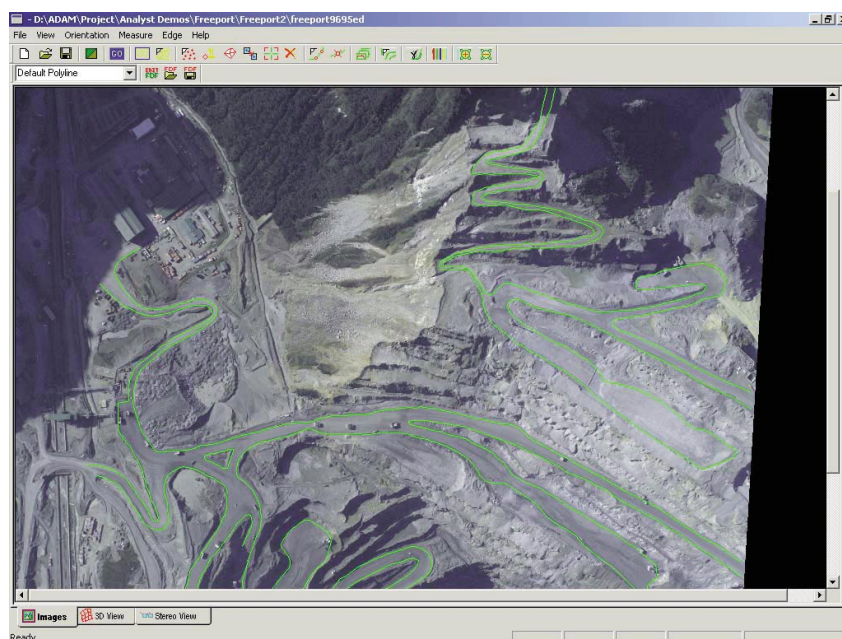
DXF export of cross sections



SINGLE IMAGE DIGITISING

Single Image Digitising is a powerful feature that allows a standard mouse to be used to digitise line features rapidly and accurately on a single image, allowing users without "stereo vision" ability to work effectively and productively with this software.

Single Image Digitising works by automatically matching the digitised point with the corresponding point in the other image using Least Squares Matching. This allows the software to determine the 3D co-ordinates of the point to within 1/3 of a pixel.



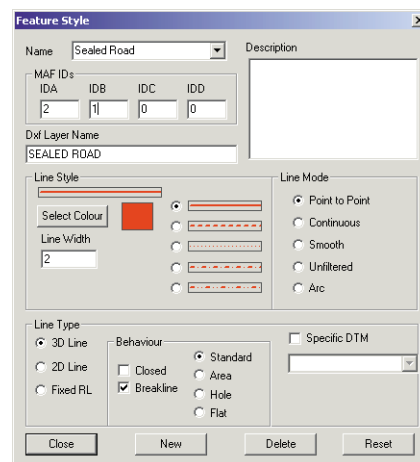
Extracting road boundaries as line features

The software also has a Stereo View that can be switched to and from at any time.

A virtually unlimited number of line feature types can be created and used for digitising. These can be exported in both MAF and DXF formats.

Line Editing

The mouse can be used to edit any line in 3D using a single image. Points can be dragged and extra points added with ease, all with sub-pixel accuracy.



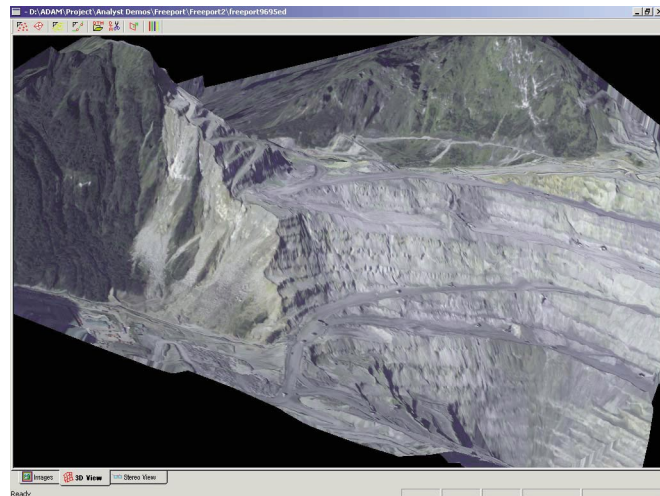
Setting up a line feature type

3D VIEWING WITH TEXTURE

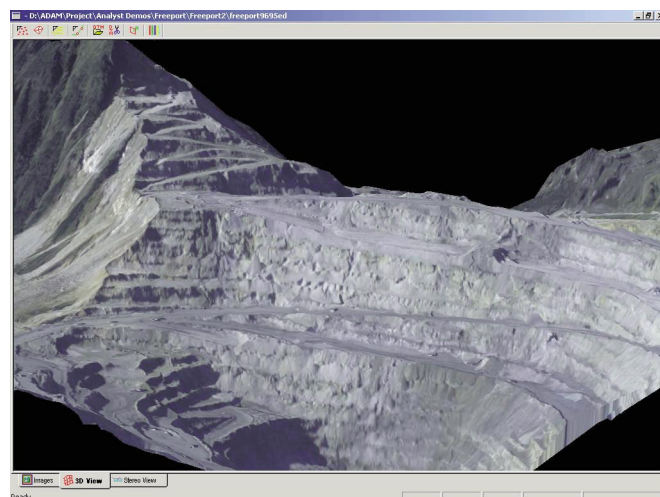
The original images can be draped over the DTM and digitised data to provide graphic three-dimensional views of the mine from any angle or distance.

These 3 dimensional views of the site are useful for:

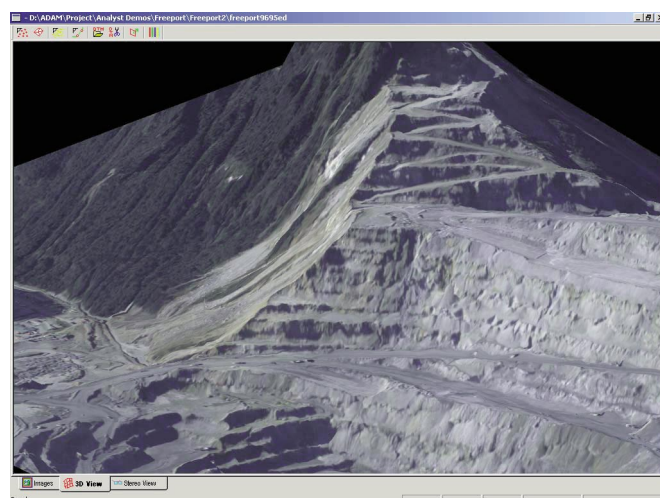
- Management overview
- Site planning sessions
- Site visitor indoctrination
- Employee training
- Safety planning
- Geological examination
- Status checking and recording
- Historical data collection and review
- Reports and promotional material



Left view



Centre view



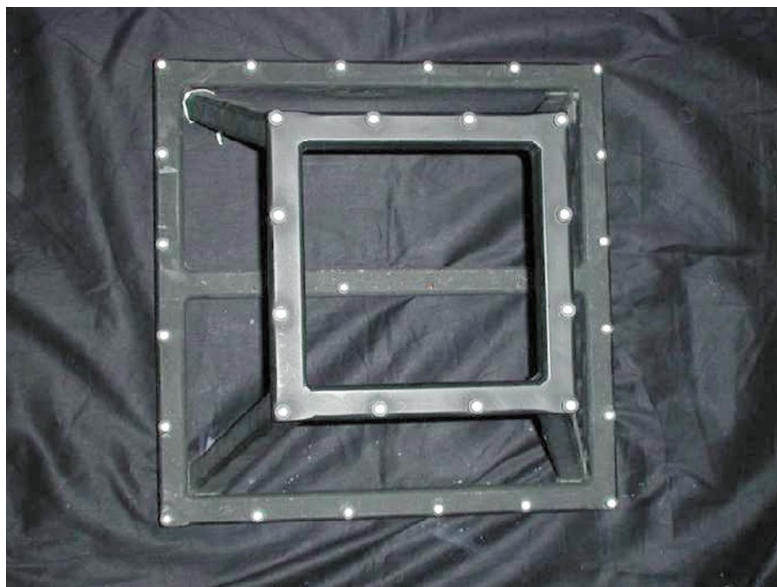
Right view

DIGITAL CAMERA CALIBRATION

Camera and lens calibrations can be performed rapidly and easily with the 3DM Analyst software using a simple target range.

A target range consists of a suitable area with circular targets set out to cover an area large enough to fill the camera view at the required focus setting. Accurate target co-ordinates are then required for each of the targets.

Two images of the target range are taken from different positions. The target positions are digitised and this information is used in the software, along with the target co-ordinates, to perform the camera calibration.



Purpose-built calibration frame for close range photography



Outdoor calibration range for larger model areas

COST EFFECTIVENESS

Advantages of using digital cameras

- No scanning required
- No film processing or storage problems
- No film distortions — interior orientation is only performed once (during camera calibration) rather than once per image

Advantages of 3DM Analyst software

- Exterior orientation routines specially designed for terrestrial work with minimal control
- Lower cost survey data
- Better targeting accuracy than a human observer
- Shorter time frame, from capture to data delivery
- Denser data where required
- Geological data can also be extracted using this system
- Portable system

A Comparison between the ADAM 3DM Analyst and the ADAM MPS-2* system

PROCESS	MPS-2	3DM ANALYST	3DM ANALYST COMMENTS
Capture Images	Same		
Process Film	1 hour	0 mins	Not required.
Load images	2 mins	2 mins	Download from camera
Pre & Interior Orientations	10 mins	0 mins	Digital CCD back, no film distortion, done with camera lens calibration
Exterior Orientation	10 mins	2 mins	No human error, accurate target centroiding software assisted functionality
DTM Observation	1000 – 1500 pts/hr	11,000 pts/min	Can be produced without specialist stereo operator

* The ADAM MPS-2 Microphotogrammetric System is a full analytical small format stereoplottter typically used for mine-site photogrammetric operations.

Technical Specifications

Photography Any digital camera can be used, from a simple hand-held, low-resolution camera, to the most sophisticated available on the market. Scanned images from calibrated film cameras can also be used. The 3DM Analyst can calibrate digital cameras directly, or import standard camera and lens calibration details for film cameras.

Either traditional aerial or terrestrial/oblique imagery can be used, with the standard 60% overlap for multiple image models, or convergent pairs of images for single models.

Data Exports DTM points and triangle feature data, extracted line feature data, contours, and cross-sections can all be exported in standard DXF format or ADAM's own MAF format for input into other software packages.

Training ADAM Technology can provide operator training if required. Effective operator training can be achieved in a very short time. No previous training or special photogrammetric knowledge is required for normal operation. All complicated mathematical processes are performed automatically by the software, requiring only simple selections and inputs from the operator.

COMPUTER REQUIREMENTS

Hardware The minimum specification for using digital camera imagery are 256MB of RAM and a Pentium II or better. For using scanned images from film cameras, we recommend 512MB of RAM and an Intel Pentium III/AMD Athlon or better.

OS Microsoft Windows NT 4.0 Service Pack 6a or better, Microsoft Windows 2000, or Microsoft Windows XP.

Display The 3DM Analyst supports, and can be supplied with, a range of stereo viewing options. Supported hardware includes StereoGraphics' Monitor Z Screen 2000 and Crystal Eyes products.



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