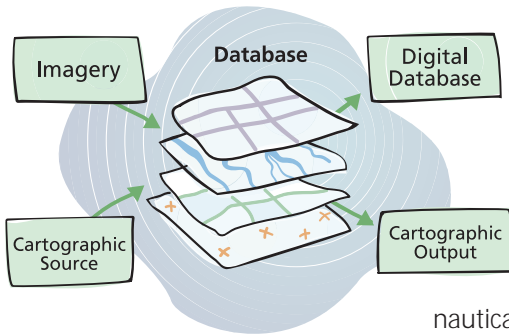


Production Line Tool Sets

Production Line Tool Sets



Production Line Tool Sets (PLTSs) by ESRI are a collection of software applications for building and maintaining digital databases and for cartographic map production. These tools have been developed to produce standard National Imagery and Mapping Agency (NIMA) products. These products include digital data in Vector Product Format (VPF) and hard-copy products, such as military topographic maps and nautical charts, that meet NIMA specifications. The tool sets, currently in use at NIMA, ESRI, and many commercial contractors around the world, have been successfully employed in high volume production environments. They have also been successfully installed and adapted to support other government and international mapping agencies in producing and maintaining a broader range of products.



PLTS Start Menu



Sample topographic line map produced from imagery source

History of the PLTS

The PLTS software has been developed over the last 10 years within the ESRI Database Services Department on actual production projects. The tools have evolved over the last five years into simple, easy-to-use, menu-driven components that form a highly integrated system for producing digital databases and cartographic products. These tool sets operate on top of standard ESRI® base software.

Database-Driven Cartography

The Production Line Tool Sets are database driven, capturing hard-copy, digital, and imagery sources into a central database and producing both soft- and hard-copy products from this single database. The central database offers two views of the data: an accurate database view and a cartographic symbolized view. Database features are attributed with codes describing each feature, providing accurate representation. The cartographic symbolized view is created with the Map Production System (MPS), which is a highly customizable cartographic symbolization and editing tool. This database-centric approach simplifies and facilitates product generation and maintenance and ensures data consistency in product generation.

Work Flow-Based Tools

Each phase in the production work flow is supported by at least one module of the Production Line Tool Sets. These modules and procedures guide users through an easy step-by-step process for producing these products.



Stereo feature extraction

The Production Line Tool Sets

- ▶ Vector Map Level 1 (VMap 1)
- ▶ Vector Map Level 2 (VMap 2)
- ▶ Foundation Feature Data (FFD)
- ▶ Digital Nautical Chart (DNC)
- ▶ Urban Vector Map (UVMaP)

Seven PLTS components are included in each of the applicable tool sets.

- ▶ Map Production System (MPS)
(also offered separately)
- ▶ GIS Data ReViewer
(also offered separately)
- ▶ Correct Errors
- ▶ QCView
- ▶ DBEdit
- ▶ DTEDQC
- ▶ Vector Product Format

Vector Map Level 1

There are two tool sets for VMap production, the Production Line Tool Set for VMap Level 1 (VMap 1) and the Production Line Tool Set for VMap Level 2 (VMap 2). Each of these includes tools for data capture from cartographic sources and tools for input from image-extracted data sources. Cartographic sources include hard-copy products such as Topographic Line Maps (TLMs) and Joint Operations Graphics (JOGs). Image-extracted source data is extracted in a three-dimensional extraction system.



Imagery

Cartographic Sources

VMap 1 and VMap 2 include tools for scanning, converting, and attributing data. They also allow for the quality control of data captured from cartographic map sources such as color lithographic maps, map film separates, and digital source information, which can then be converted into VMap-specific ArcInfo™ databases.



Cartography



Joint Operations Graphics

The VMap Level 1 database can be used to generate JOGs at 1:250,000 scale. Both the TLM and JOG cartographic products generated in the MPS component are fully compliant with NIMA product specifications.

VMap2

Vector Map Level 2



Imagery Sources

VMap 1 and VMap 2 include tools for converting feature and terrain data extracted from SOCET SET®, the BAE Systems product for stereo extraction, or Autometric, Inc. SoftPlotter™ stereo extraction system into VMap-specific ArcInfo databases. Included are tools for capturing ancillary source information to the VMap-specific ArcInfo databases. Tools for monoscopic image extraction and update are also provided within the DBEdit component.



File Import tool

- | | | | |
|--------------------------|--------------------|--------------------------|------------------------|
| - Extracted Feature Data | - ASCII Files | - Coverages | - Final VMap Coverages |
| - Monoscopic Imagery | - F_CODE Coverages | - Processing | |
| - DTED | - FACC Codes | | |
| - IGDS | | | |
| - Film | - Scan | - Coded Vector Coverages | - Final VMap Coverages |
| - Litho | - Digitize | | |

TLMs
JOGs

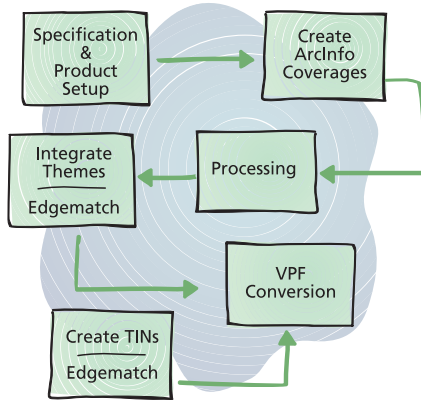


Topographic Line Maps

The VMap Level 2 database can be used to generate standard TLMs at 1:25,000, 1:50,000, or 1:100,000 scales. The TLMs are produced using the MPS, the cartographic component of the PLTS software.

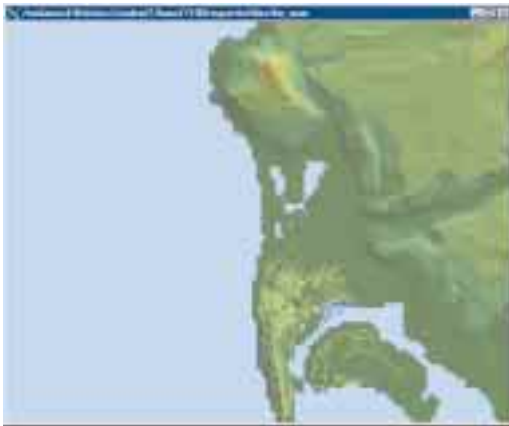
FFD Foundation Feature Data

The Foundation Feature Data (FFD) Production Line Tool Set is used to produce NIMA standard FFD databases in VPF from features and elevation data extracted primarily from stereo imagery. The tool set provides a menu-driven interface to all of the ARC Macro Language (AML™) scripts needed for FFD database production. Included are tools for the conversion of feature and terrain data, modeling of three-dimensional features, capture of ancillary cartographic source information, generation of a complete FFD-specific database, generation of contours from Digital Terrain Elevation Data (DTED), and conversion of the database to a VPF standard FFD product.



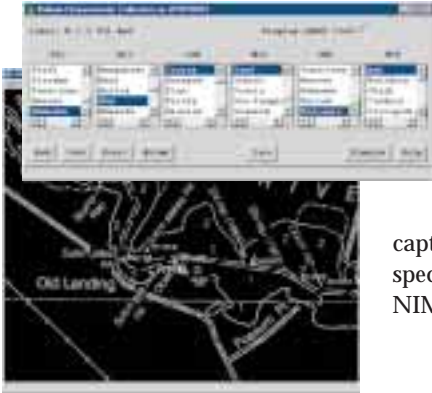
Three-Dimensional FFD

The FFD Production Line Tool Set has tools that allow the database to store the z-coordinate value for each vertex in the database in a triangulated irregular network (TIN) surface. TINs are used within the VPF conversion tools to transfer the z value to the VPF data set as VPF conversion is taking place.



DNC

Digital Nautical Chart



The Digital Nautical Chart (DNC) Production Line Tool Set is used to produce NIMA VPF standard DNC databases from existing NIMA Harbor Approach Coastal and general charts or National Oceanic and Atmospheric Administration (NOAA) charts. This production line has been used extensively by a number of organizations for the production of NIMA DNC databases. The production line includes tools for the capture of cartographic source information, generation of a complete DNC-specific ArcInfo database, quality control of the database, conversion to a NIMA standard VPF DNC product, and cartographic chart generation.

Harbor Approach and Coastal Charts

The DNC database can be used to generate standard NIMA Harbor Approach and Coastal (HAC) charts at various scales. The HAC charts are produced using the MPS, the cartographic component of the PLTS software. The MPS has the capability to generate the various layouts and scales associated with nautical charts. Automatic generation of surrounding elements and their positioning are built into the system.



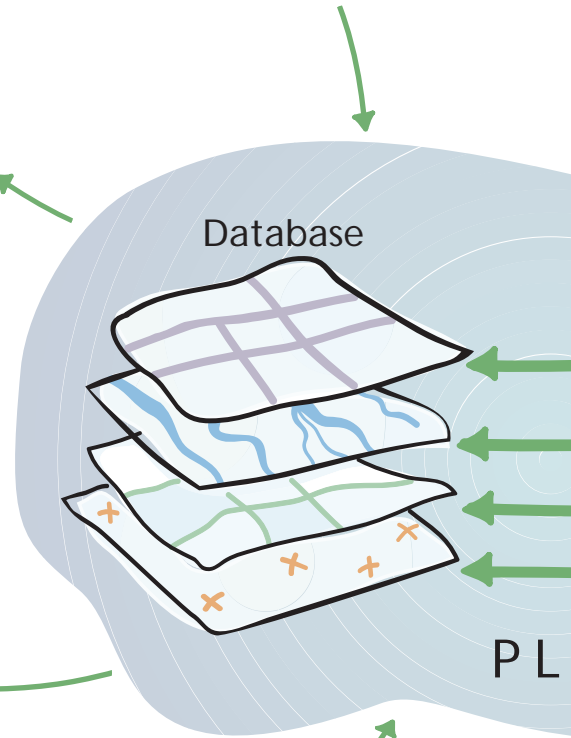
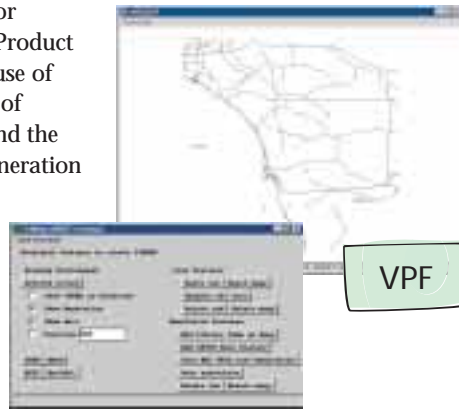
UVM

Urban Vector Map

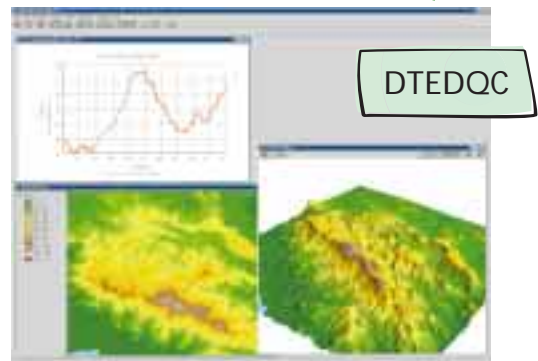
This Production Line Tool Set has been used extensively for the production of NIMA Urban Vector Map (UVM) databases derived from existing city graphic maps. The PLTS includes tools for capturing cartographic source information, feature attribution, quality control, generation of a complete UVM-specific ArcInfo database, and conversion of the database to a NIMA standard UVM VPF product.

The PLTS Components

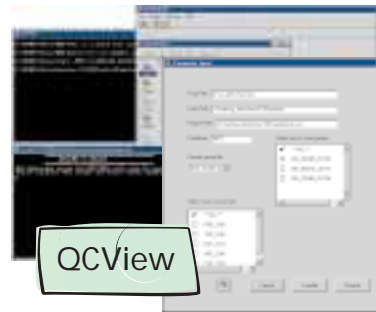
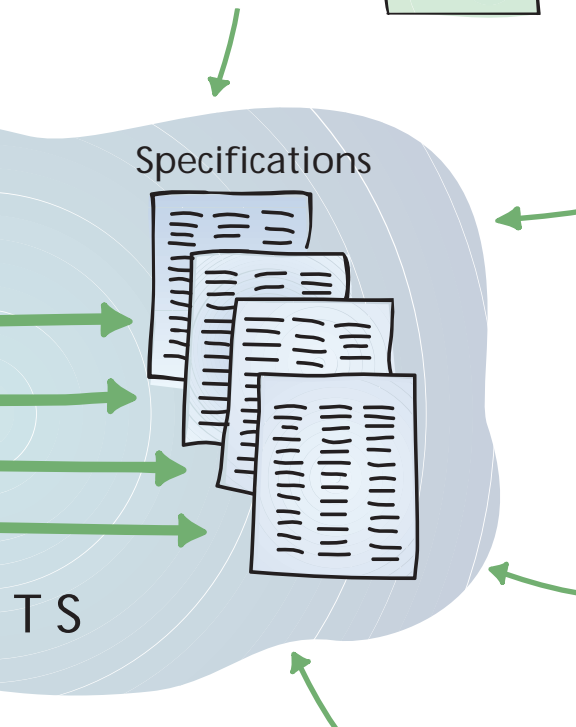
Each PLTS contains a number of components, many of which are shared between the different tool sets. As new components are added, they can be “plugged in” to the existing PLTS system. These components are used together and in sequence to perform specific tasks in the production process. The components interact with the ArcInfo database in one of two ways: (1) database creation and validation or (2) product generation. Product generation includes the use of the MPS for production of cartographic products and the use of the VPFKit for generation of VPF data. Access to the different tool sets is done through a PLTS menu or by specifying the product by its name at the ArcInfo prompt.



Offered separately.



PLTS and Specification Files

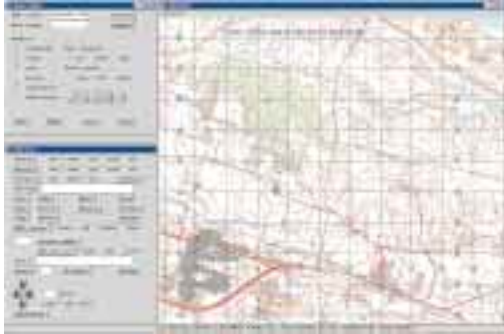


The PLTS components work together through a series of database specification files that define the behavior for each of the components in the PLTS. These specification files are derived from the NIMA specifications for each product, the ArcInfo database design, and the internal requirements of the PLTS software.

Some of the specification parameters are feature attribute table definitions, valid value tables, attribute consistency tables, VPF layer descriptions, VPF primitive types, cartographic feature to symbols assignment, text placement rules, and map generation parameters. Customization for additional products can easily be supported through the creation of new specification files.

Map Production System

The Map Production System is a menu-driven application designed to facilitate the cartographic production of topographic and hydrographic maps. The supplied symbolsets and generation tools combine to form map products that meet NIMA specifications. PostScript® files can be generated directly from the system to create film separates, or printing plates can be created via a “computer-to-plate” process.



Map Editor

A full set of cartographic editing tools and generation tools is included for creating a variety of map elements such as north arrows, scale bars, adjoining sheet diagrams, and elevation guides. Elements can be edited and the map layout customized using map composition editing tools.

Data Editor

This system includes a number of data manipulation tools to project, symbolize, and annotate data and features. The data can then be cartographically edited in a what-you-see-is-what-you-get (WYSIWYG) editing environment prior to basemap generation.



Map Products

The system supports the production of HAC charts; Joint Operations Graphic-Air (JOG-A) series maps; and TLMs at 1:100,000, 1:50,000, and 1:25,000 scales. It can also be fully customized to create unique map products. ESRI has produced other map series with MPS and welcomes the opportunity to customize these tools for customer-specific needs.

GIS Data ReViewer

The GIS Data ReViewer was developed by ESRI in order to help ESRI, NIMA, and NIMA's outsourcing contractors using ArcInfo and ArcView® GIS software to conduct visual quality review of data in support of database production. The ReViewer consists of a series of buttons and scripts that have been added to the ArcView GIS interface to facilitate the review of data in ArcInfo and VPF formats. The GIS Data ReViewer eliminates a paper trail of errors by storing the error information in an electronic file. The error file or table contains information associated with each individual error found in the database such as x,y location, coverage name, feature class, error description, and error date.

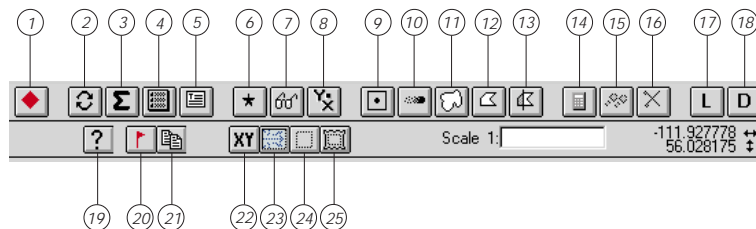


Symbolization

The ReViewer automatically loads and symbolizes features for each PLTS database type in a consistent and organized manner. After the data is loaded the user can systematically review data layers for errors.

Resampling

The ReViewer has the capability to create random feature samples based on a percentage of the features contained in a layer. Additional features can be added to the sampled set by identifying critical attributes that need 100 percent review.



1. Commit an existing feature to the error table
2. Convert and label heights and depths
3. Summarize theme by F_CODE
4. Generate theme frequency reports
5. Query theme for notes/.rat tables
6. Select all named features
7. Zoom to a particular named feature
8. Zoom to a point
9. Find points in polygons
10. Find duplicate points
11. Find minimum area polygons
12. Find sliver polygons
13. Check attribution across tile boundaries
14. Sample a percentage of the active theme
15. Step through sample theme features
16. Delete a sample theme
17. Change the coordinate display to degrees, minutes, seconds
18. Change the coordinate display to decimal degrees
19. Display existing feature attributes
20. Commit a missing feature to the error table
21. Duplicate an error in the error table
22. Freeze coordinates at a user-defined location in decimal degrees and degrees, minutes, seconds
23. Generate a qc grid
24. Zoom to user-specified rectangle
25. Zoom to a qc grid cell or tile

The PLTS Components

(Included with each PLTS)



Correct Errors

The Correct Errors tool uses the error table generated from the GIS Data ReViewer to locate errors in the ArcInfo database so that they can be corrected. An operator visits each error in the error table and makes the required change in the database. After each change is made a correction status is added to the table identifying what was done to the feature.

Revisit and Tracking

The error table can then be loaded back into the GIS Data ReViewer for the quality control analyst to verify that the correction was done properly. This creates an error tracking cycle that is 100 percent verifiable.

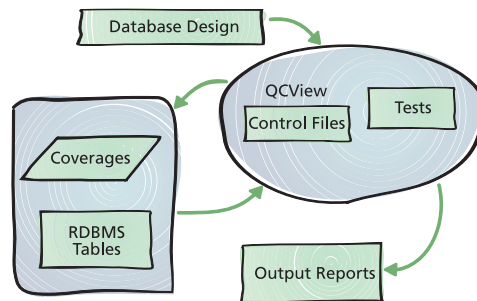


QCView

QCView allows for quality control checks of any ArcInfo coverage and relational database management system (RDBMS) table, Structured Query Language (SQL) server, Oracle®, Informix®, Sybase®, dBASE® storing attribute information. QCView validates that the ArcInfo data structure, coverage format, and topologic structures are correct.

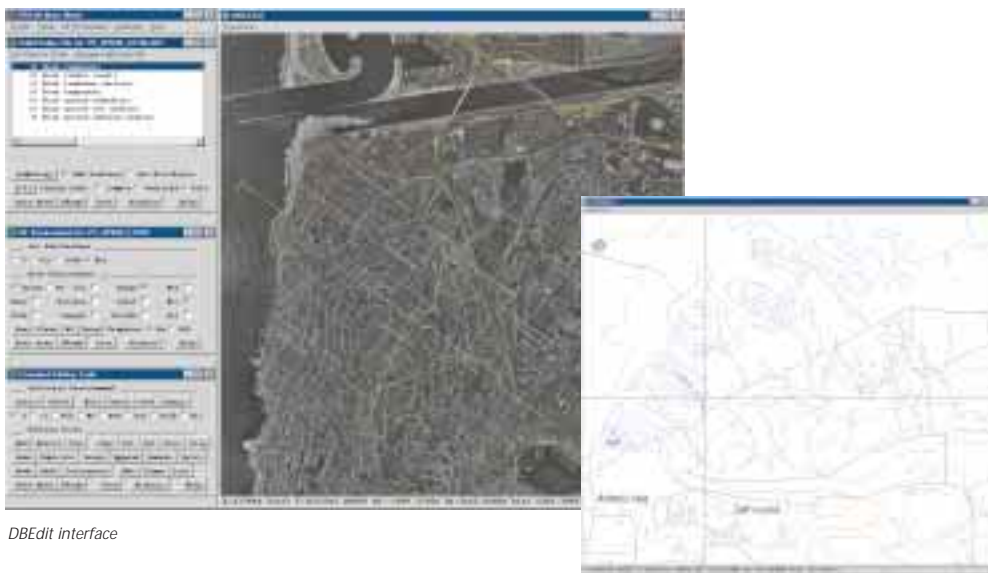
QCView's Output

The operational structure of QCView stresses simplicity and the ease of customization of the application. Specification files contain all of the database information needed to validate that a data set meets the database requirements. The result of running QCView is a series of error reports identifying discrepancies between the data and the product specifications. These reports are then used to make corrections to the database.



DBEdit

DBEdit is a data editing tool built on ARCEDIT™ to improve the efficiency with which ArcInfo vector data is produced and edited. Many frequently used commands, which would ordinarily be typed at the command line, are replaced with buttons on a menu to simplify their use. Attribute entry is streamlined using valid value files for each data set in the PLTS.



DBEdit interface

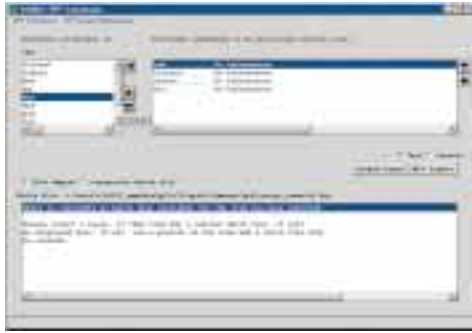


Valid Value Files

Valid value files contain all the valid attribute combinations and can be used to add fully coded features to a database or to attribute existing features in a database. DBEdit can use imagery as a backdrop for editing, simplifying monoscopic extraction, or map revision.

The PLTS Components

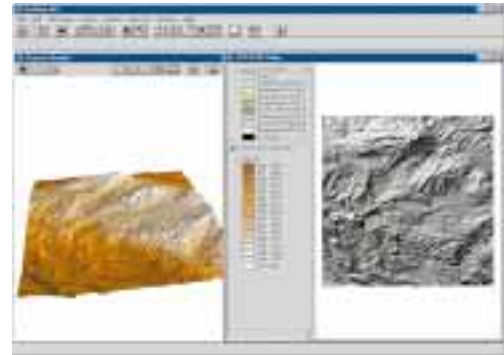
(Included with each PLTS)



Vector Product Format

ESRI, in conjunction with NIMA, developed the Vector Product Format standard for the Digital Chart of the World (DCW). VPF is now used for all NIMA product databases. ESRI's fully menu-driven VPF conversion process includes, but is not limited to, data tiling, meeting the 1993 or 1996 VPF standard, merging metadata with spatial data, converting to VPF, and tailoring to meet each product specification.

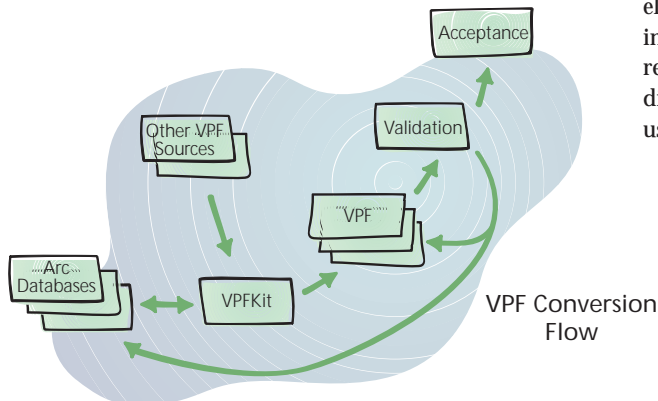
The complexity of the VPF product specification can make the VPF conversion process a very expensive and resource-intensive task. ESRI has made it a goal to make VPF conversion easier and more efficient for the user. ESRI's VPF tools (VPFKit) are the result of many years of experience converting and working with VPF databases.



DTEDQC interface

DTEDQC

DTEDQC is used to perform quality reviews of Digital Terrain Elevation Data. A series of buttons and scripts has been added to ArcView GIS to customize it for finding abnormalities in the elevation model. These scripts allow the operator to import a DTED file, create contours, create shaded relief, derive slope and aspect, and generate a three-dimensional scene. All of these feature types are then used for visually inspecting the DTED.



Support and Training

Production Line Tool Set Support



ESRI offers technical support for each PLTS and its component tools through a maintenance support plan purchased on an annual basis after the first year. Included are telephone hot line, fax, and e-mail support; bug fixes to existing AMLs and data files; and application updates. Clients may utilize e-mail, voice mail, or fax communications 24 hours a day, seven days a week. The ESRI PLTS support team staff will respond to client support requests five days a week, 6:00 a.m. to 6:00 p.m. Pacific time. Support calls are channeled through the technical support number to the PLTS technical support team. Since the Production Line Tool Sets and component tools are also in use at ESRI, users will benefit from our own process improvement as the applications continue to be enhanced in a full production environment. Custom support packages can also be quoted on a time and materials basis to meet any specific need.

Production Line Tool Set Training

In addition to support, ESRI offers training for each PLTS and its component tools. We highly recommend training for key staff who will be using these tool sets. The training, which varies in length from five to 20 days, can be conducted either at the ESRI headquarters training facility in Redlands, California, or at any appropriately equipped client site.

Hardware operating environment is as follows:

Hardware Platform	Operating System
Sun™	Solaris™ 2.5 or greater
Silicon Graphics®	SGI IRIX™ 6.5 or greater
Intel® Pentium®	Windows NT® 4.0

Production Line Tool Sets	
<input type="checkbox"/>	Vector Map Level 1 (VMap 1)
<input type="checkbox"/>	Vector Map Level 2 (VMap 2)
<input type="checkbox"/>	Foundation Feature Data (FFD)
<input type="checkbox"/>	Digital Nautical Chart (DNC)
<input type="checkbox"/>	Urban Vector Map (UVMMap)
Component Tools (offered separately)	
<input type="checkbox"/>	Map Production System (MPS)
<input type="checkbox"/>	GIS Data ReViewer

The PLTS software can be made available on other UNIX platforms; however, ESRI time and materials services may be required to perform porting and testing. The Production Line Tool Sets currently utilize Scan-graphics® scanners and Hewlett-Packard® inkjet plotters. ESRI time and materials services are available to support clients wishing to adapt to other input and output devices.

Required and Recommended Software

The following ESRI and third party software programs are required to support operations of the Production Line Tool Sets and component tools.

Production Line	ArcInfo and Extensions					Maplex	ArcView GIS and Extensions		
	ArcInfo	ARC GRID™	ARC TIN™	ArcScan™	ArcPress™		ArcView GIS	ArcView Spatial Analyst	ArcView 3D Analyst™
Tool Sets									
VMap 1	●	●		■	■		●	●	●
VMap 2	●	●		■	■		●	●	●
FFD	●	●	●	■			●	●	●
DNC	●	●		■	■	■	●	●	
UVMap	●	●		■			●		
Component Tools									
MPS	●	●			●				
ReViewer							●		

■ ArcScan, and ArcPress are not required, only recommended.

Notes: Bitstream fonts are required for the production of JOG, TLM, and HAC chart hard-copy maps. Perl programming language is required for all of the Production Line Tool Sets and is provided with all PLTs. ARC/INFO 7.2.1 is required for VPF conversion to the VPF 96 standard. Minimum version requirements for ESRI core software are ARC/INFO 7.2.1 and ArcView GIS 3.1.



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