MERLIN

MERLIN: Enterprise-wide Geospatial Analysis

with

TNTmips®

and TNTserver™

Software to Get Started

MicroImages, Inc. has created a professional suite of software products for advanced geospatial data visualization, analysis, and publishing. **TNTmips**®, **TNTview**®, and **TNTedit**™ all offer a wide variety of tools for those working in the many fields that make use of Geographic Information Systems (GIS). The purpose of this booklet is to acquaint you with a model enterprise solution that uses these concepts and tools for the assembly, management, and analysis of spatial data covering an entire state. All of the features required for a robust GIS system are available in TNTmips, which was used to build the MERLIN system and is a point of reference throughout this booklet.

TNTserver™ is a geoserver, designed first and foremost to allow rapid access, viewing, and interpretation of massive collections of geodata, which includes raster, vector, CAD, and TIN data. The geodata served by TNTserver is viewed using **TNTclient**, which is a web-based Java client that is downloaded and cached on your drive for repetitive use by most browsers, *or* using **TNTbrowser**, which is a free Windows application. You download and install TNTbrowser, then run it like any other Windows program. TNTclient and TNTbrowser are free.

TNTatlas® is another free product from MicroImages that lets you view and distribute atlases created with TNTmips. Atlases small enough to fit on CD-ROM can be published and distributed with TNTatlas for use on any popular computer platform.

TNTmips and TNTlite® TNTmips comes in two versions: the professional version and the free TNTlite version. This booklet refers to both versions as "TNTmips." If you did not purchase the professional version (which requires a software license key), TNTmips operates in TNTlite mode, which limits the size of your project materials and enables data sharing only with other copies of TNTlite. Exploring MERLIN and other sample atlases makes use of other free products from Micro-Images, the downloadable TNTclient or TNTbrowser.

Merri P. Skrdla, Ph.D., 14 June 2000

It may be difficult to identify the important points in some illustrations without a color copy of this booklet. You can print or read this booklet in color from MicroImages' web site. The web site is also your source of the newest Getting Started booklets on other topics. You can download an installation guide, sample data, and the latest version of TNTlite.

http://www.microimages.com

Introducing MERLIN

The online MERLIN (Maryland's Environmental Resources and Land Information Network) system is an electronic atlas provided by the Maryland Department of Natural Resources (MDNR) for public viewing and internal use. The information in this atlas came from and is used by many other state agencies, such as the State Highway Authority and the Maryland Office of Planning (see page 4 for a comprehensive list).

Many, many different layers of data are included in the MERLIN system, which is why it is so useful for varied purposes. It includes natural color or color-infrared airphoto coverage of the entire state at a map scale of 1:12,000 with each pixel representing approximately one meter on the ground. There are vector overlays for watershed, shoreline changes, submerged aquatic vegetation, floodplains, roads, land use, and many more themes. There is SPOT coverage with quad grid overlays to help you locate your area of interest at the county level. Many of the layers have associated metadata that describes the collection and quality of the data. The different types of geospatial data all play an important, complementary role in forming the complete picture.

The degree of organization and quality built into the MERLIN system enables MDNR and others to rapidly respond to map requests in emergency situations. For example, in response to a recent oil spill MDNR was able to produce more than 50 plot files and nearly 200 E-scale maps in a matter of days for support of the cleanup and assessment operations.

You can view the MERLIN system for the entire state of Maryland at http://www.mdmerlin.net or view a subset of this atlas for Anne Arundel County only at http://www.microimages.com/atlasserver.

TNTserver is fully scalable from gigabytes to terabytes of data without affecting performance. You can start your atlas with a single county covered by micro and macro views and scale that up to coverage of the entire state with similar data. The size of the atlas simply does not matter when working with TNT-server.

Cooperation Required

MERLIN Online is produced with cooperation from:

Government Agencies

State Government

- MD State Government Geographic Information Coordinating Committee (MSGIC)
- MD Department of Agriculture
- MD Department of the Environment
- MD Department of Housing and Community Development
- MD Department of Natural Resources
- MD Office of Planning
- MD State Highway Administration

Federal Government

- Federal Emergency Management Agency
- NASA's Earth Science Enterprise
- U.S. Fish & Wildlife Service, National Wetlands Inventory
- U.S. Geological Survey

Private Sector Companies

- CNES/SPOT Image Corporation
- EarthData
- MicroImages, Inc.
- Eyemap by Vargis LLC

Colleges and Universities

- Center for Geographic Information Sciences at Towson University
- Virginia Institute of Marine Sciences

Non-Profit Organizations

- American Farmland Trust
- Chesapeake Bay Foundation
- The Maryland Ornithological Society
- The Nature Conservancy

There can be no enterprise-wide effort without cooperation, which is not the way many large organizations have traditionally been run. Middle managers are not motivated to share the information acquired by their department because it may somehow diminish their power. Clearly such strategies are not advantageous to the organization as a whole.

In many large organizations, data may be duplicated between departments or agencies not only because they are unwilling to share data—sometimes they simply do not know of the duplicated effort. Think also of the cases where you were sure the data you wanted was available, but you did not know how to get at it. What if these barriers to data usage were gone? Only in an ideal world you say? Take a look at MERLIN. Many state and federal government agencies are freely providing their data for use by other agencies and the public, and all you need to know to find information is the geographic location or the county name with which it is associated.

Cooperation of this magnitude requires organization of the extensive detailed information scattered across various jurisdictions. It also requires strict management and quality guidelines so that all geo-data works together for detailed local use. Software of varying kinds that works together seamlessly to handle all of these tasks (from data preparation to publication and distribution) is also necessary.

Such cooperation does not preclude inclusion of proprietary data. For example with MERLIN Online, the layers related to Sensitive Species Project Review Areas and Historic Sites identify generalized areas as containing sites of concern without providing any exact locations of resources. The generalized information is sufficient to alert a developer that additional steps are required before proceeding with any projects in the area. The polygons are coded, however, so more specific information can readily be retrieved by those authorized to do so.

Web Sites for Viewing MERLIN

The MERLIN atlas provides direct Internet access to an enormous quantity of highly detailed information. The size of this atlas is continually changing, but hovers around 240 gigabytes before compression. The size is continually changing because components are added or updated. The atlas structure and TNTserver (see p. 2) are totally scalable without changes in performance and without altering existing geodata. All that is required to demonstrate this scalability is additional drive space. Increases in the number or resolution of orthophotos can quickly change the atlas size by orders of magnitude without altering TNTserver performance.

You can view the MERLIN system for the entire state of Maryland at Maryland's web site or view a subset of this atlas (Anne Arundel County) at MicroImages' web site. (MicroImages' web site also provides a link to the Maryland site, which is listed as *Maryland Statewide* under Public Atlases.) The steps you go through to launch MERLIN at these two web sites differ, but the methods and functionality are identical once TNTclient or TNTbrowser is launched.

Steps to launch MERLIN at Maryland's site:

☑ http://www.mdmerlin.net
☑ click on Make a Map in the left panel
☑ read the Notices that appear in the right panel and click the OK button at the bottom

Steps to launch MERLIN (Anne Arundel County only) at MicroImages' web site:

☑ http://www.microimages. com/atlasserver
☑ click on the AtlasServer compass or on the Map/ Image Server text
☑ choose *Anne Arundel County, MD* from the list of public atlases
☑ click on the *Launch the Atlas* icon

MERLIN Online has two components: the web site (left) and the atlas itself (below). The atlas is not viewed directly in your web browser but using TNTclient or TNTbrowser in conjunction with TNTserver.
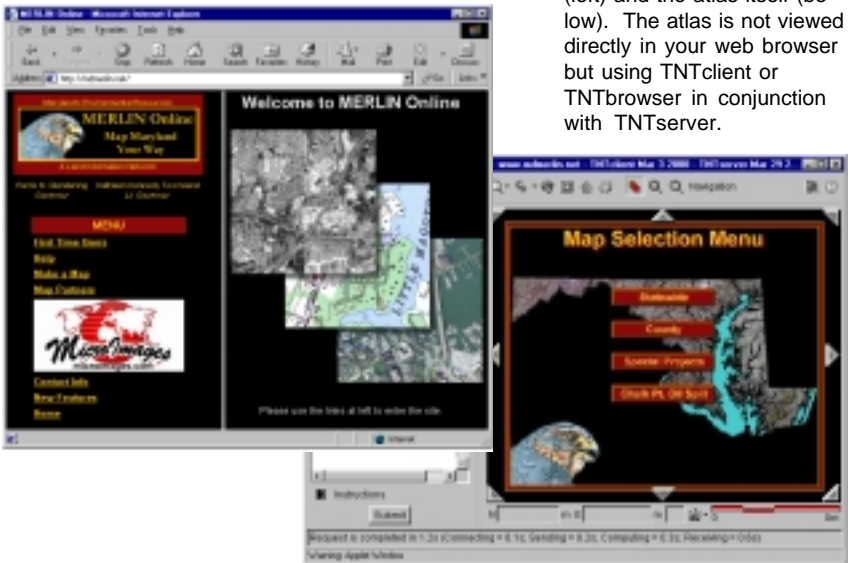
Magnitude of MERLIN Data

You can select the county of further interest graphically from a Landsat TM image overlaid with county outlines...

...or from an alphabetical list of county names

The MERLIN Online imagery is organized by USGS 7.5' topographic map quads on a county by county basis. After you select a county, you can view a variety of vector overlays on the full county SPOT image or in conjunction with the topographic maps or natural color or color-infrared ortho-photos at the next level down in the atlas hierarchy. Property (par-cel) maps are also available on the orthophoto / topographic map level.

Most, but not all, data layers are the same for all counties. For example, Anne Arundel and Balti-more Counties have a Critical Areas layer, while St. Mary's, Calvert, and Kent Counties do not. Kent County is the only one of these five counties that lacks a 100 & 500 Year Floodplain layer. There may be as many as 70 themes to choose from with some themes having multiple layers to cover the complete 7.5' map quad. Although the data is primarily the same from one 7.5' map quad to the next, the actual number of layers may vary. The greatest variability is seen in the number of separate property maps associated with a 7.5' quad layout, which may range from about 10 to more than 30 to cover the area.

Combining overlays with base imagery (SPOT sat-ellite imagery, orthophotos, or topographic maps) provides a means of performing your own visual geospatial analysis by interrelating and comparing information in your selected layers and the ground features and topography in the base image/map.

The seamless combination of base images and over-lays is possible because all the data is georeferenced, which means geographic reference points have been introduced for all the separate layers. This georef-erence ties the data to the area represented on the ground. All data then automatically displays in correct relative position.

Consider the User

The people who will use the atlas should be an important consideration in atlas design. If the atlas will be used only by employees of your organization, you may be able to include acronyms without explanation or a lot of the jargon from your field. If there is any possibility of public access, however, such insider terminology should be eliminated. Even if your atlas is for internal use only, you need to consider who within the organization will use it—not only as a consumer of the completed atlas but for data entry and assembly.

The MERLIN acronym is spelled out at the upper left of the home page.

A well designed atlas should be intuitive to use. It should not leave the user wondering what they have seen or frustrated at their inability to reveal any more information. MERLIN runs with TNTserver in conjunction with TNTclient or TNTbrowser, which have complete help files describing all the functions available for viewing geodata and navigating to other levels of the atlas. This complete help (available from the User's Guide option under Help Topics) also describes all the features, such as the measurement tools, InfoTips, and how to zoom in and out. The MERLIN site also provides a Quick Reference Guide that pops in short descriptions of TNTclient components as you move the cursor over a sample window. Quick tutorials and Frequently Asked Questions are also accessible from the MERLIN home page to assist you in getting the most from the materials provided by MERLIN Online.
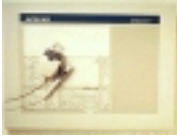
Although many of the Map Partner logos that rotate through MERLIN's home page contain acronyms, all are spelled out in the Map Partners panel.
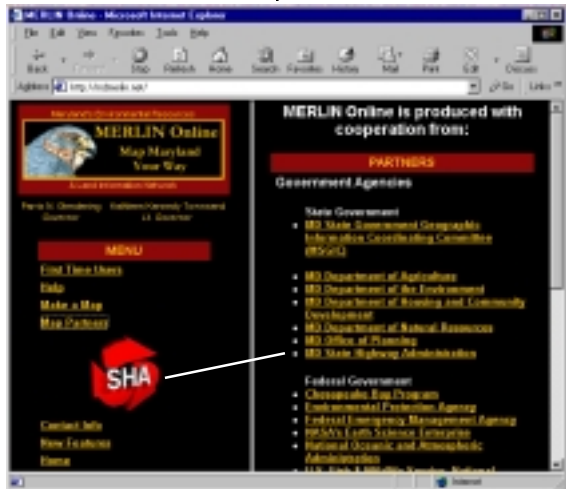
Necessary Tool Support

ODBC Data
Sources (32-bit)

A variety of tools are needed to create and assemble the geodata and graphics you need for enterprise-wide geospatial analysis. You need a means to get data into the system. You may have paper data that needs to be scanned, such as maps and orthophotos, or you may have data appropriate for conversion with a digitizing tablet. Some data may be already in digital form but in a variety of different formats that are not compatible for use in a single system. Utilization of such data requires either import or direct linking. With import, the data is converted to another format, which most likely cannot be read by the software that created it, for more efficient use by the importing system. With direct linking, the data remains in an external format that can be directly read and, in some cases, written to by the new system after linking. The software that created the data also retains this capability when the file is linked.

Windows based platforms (95/98 or NT/2000) have an additional option for handling information in database form—Open Database Connectivity (ODBC) is a cross platform interface specification that gives application software, such as TNTserver, direct access to database tables in many different formats. Using ODBC, you retain all the powerful features of your database management software and also have the ability to view and write to tables in other application software.

You may also need a means to get data out of the system, either on paper or in digital form. For example, you may need to provide digitally up-dated paper maps or ungeoreferenced images for use in presentation software. If you are providing maps, you need software that supports large scale layouts and that can print to large format printers.

You also need the tools to organize and assemble your atlas and the means for you and others to access it once assembled. Your best bet is to find one system to fill all these needs.

Choose the System that Does It All

TNTmips and other TNT products provide such a system. TNTmips supports scanning and video capture directly, for some models, and using TWAIN. Input from digitizing tablets is supported using Wintab drivers.

TNTmips imports 73 raster, 26 vector, 11 CAD, and 9 database formats. ODBC is one of these database formats, which means the number of database formats supported is really much larger. Any ODBC database and five other formats can be linked to, as well as imported. Twelve of the raster formats can be linked to and AutoCAD's DXF files can be linked to in CAD format. ARC/INFO E00 and Coverage files and ArcView Shapefiles can be edited and saved in either their original or in TNTmips' internal format (RVC).

TNTmips also exports to 32 raster, 13 vector, 7 CAD, 1 TIN, and 7 database formats. Printing to most printers, including large format printers, is supported either by specific drivers or using Windows print drivers.

But TNTmips is not a glorified data translation package, it is a high powered GIS and image processing package that lets you manipulate and interpret your data in many ways. Raster data handled is not just in 8- and 24-bit color, but as 1-bit (binary), 4-bit, 8-, 16-, and 32-bit signed and unsigned integers, and 32- and 64-bit floating point. There are four levels of vector topology supported: polygonal, planar, network, and none. You can, thus, tailor the rigor of vector topology to your specific application. Also of great importance is the HyperIndex Linker tool that lets you construct hierarchical atlases.

Raster Import

ADRG	IDRISI
ADRI	IRS
AGLEADER	JERS1
AISA	JPEG
ALDEN	JPL-SAR
ARC-ASCII	LANDSAT-CCRS
ARC-BIL/BIP	LASERSCAN
ARC-E00	LVT
ASCII	MACPAINT
ASCII-XYZ	MICROBRIAN
AVHRR-BIWEEK	MRLC
AVIRIS	NEXRAD
BMP	NITF
CCRS	NLAPS
CDED	PCI
CLEMENTINE	PCX
COQ	PHOTO-CD
DEM	PNG
DEM-GTOPO30	RADARSAT
DISIMP	RESOURCE21
DOQ	SCAN-CAD-IMG
DTED	SCAN-CAD-RLC
ENVI	SDTS-DEM
EPPL7	SIMPLE ARRAY
ER-MAPPER	SPANS
ERDAS-GIS/LAN	SPOT
ERDAS-IMG	SPOTview
ERS1-SAR	SUNRAST
GAC/LAC	TERRA-MAR
GEOSOFT-GRD	TGA
GEOSOFT-GXF	TIFF
GEOTIFF	TM-FAST
GGR	TM-FAST-L7A
GIF	TM-TIPS
GRASS	USER-DEFINED
HDF4.1	
I2SPS	
IDIMS	

Vector Import

ARC-COVERAGE	MAPINFO
ARC-E00	MIF
ARC-GENERATE	MMI
ARC-SHAPEFILE	MOSS
ATLAS-GIS	NTAD
BNA	POLAR
DATABASE	SDF
DCW	SDTS
DLG-OPT	TEXT
DMDF	TIGER
DXF	TYDAC
GEOSOFT-XYZ	VPF
GRASS	

CAD Import

ARC-SHAPEFILE	GSMAP
ATLAS-GIS	MIF
BNA	MMI
DGN	MOSS
DMDF	SIF
DXF	

Database Import

ASCII	ODBC
DBASE	RBASE
INFO	TNT-TEXT
MAPINFO-ATTRIB	MOSSTYDAC-ATTRIB
MIPS-EXTERNAL	

More Reasons to Choose TNTmips

In addition to the wide variety of import and export routines; the tools to interpret and update your raster, vector, CAD, TIN, and database objects; scanner, digitizing tablet, and video capture support; and the ability to build an atlas, TNTmips provides cross-platform capability for use of the atlas once it is created. Just as TNTmips' Project Files can be used on Macintosh, Windows, and UNIX platforms without alteration, so can any atlas you produce with TNTmips.

Once you have used the tools to build your atlas, you can:

- use the atlas on your machine with any TNT product
- use it over your intranet with single user access
- distribute it on CD-ROM with the free TNTatlas
- use it over your intranet with multiple user access provided by TNTserver and a Java client
- use it over the Internet with multiple user access provided by TNTserver and a Java client.

In all of these cases, multiple platforms can use your atlas. TNTatlas, which you include on the CD-ROM with the atlas, is a free product for viewing atlases. The Java client, which is used in conjunction with TNTserver, is also a free product. There are two Java clients downloadable from MicroImages' web site: TNTclient and TNTbrowser. TNTclient is a Java applet that is downloaded from a web site when atlas viewing is requested and provides atlas access using TNTserver. TNTbrowser is an equivalent Windows application that is downloaded from MicroImages' web site and installed on your machine.

What Is an Atlas?

An atlas in the context of the TNT products is a collection of related objects used to graphically present information on a particular topic. The word *stack* is used interchangeably with *atlas* because neither term is entirely adequate. The connotation of *atlas* is geographic and omits other applications, such as electronic museums or parts catalogs. The term *stack* is inadequate because it has a linear connotation and, stacks are not limited to simple linear or treelike structures and can even be a single, complex layout. The content and structure of a HyperIndex atlas can be whatever is necessary to deliver the information you want using whatever associations you think will make the information most accessible for the intended audience.

In the case of MERLIN, an atlas provides complete coverage of the state of Maryland with either color-infrared (CIR) or natural color Digital Ortho Quarter Quads in sets of four that correspond in area to the accompanying USGS topographic maps. Water-shed, property maps, submerged aquatic vegetation, and many other themes are present. Landsat imagery of the entire state and SPOT imagery of all individual counties is also included.

To view a variety of sample atlases, visit Micro-Images' web site and choose from the public atlases.
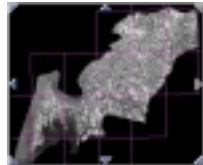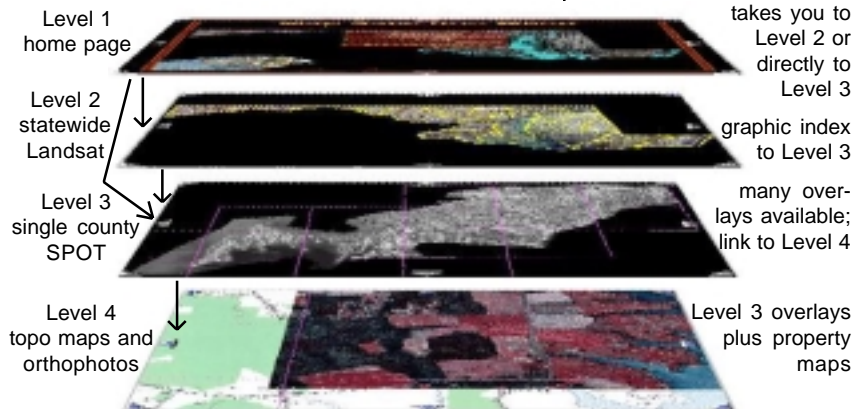
Welcome (Level 1)

State (Level 2)

County (Level 3)

Map Quads (Level 4)

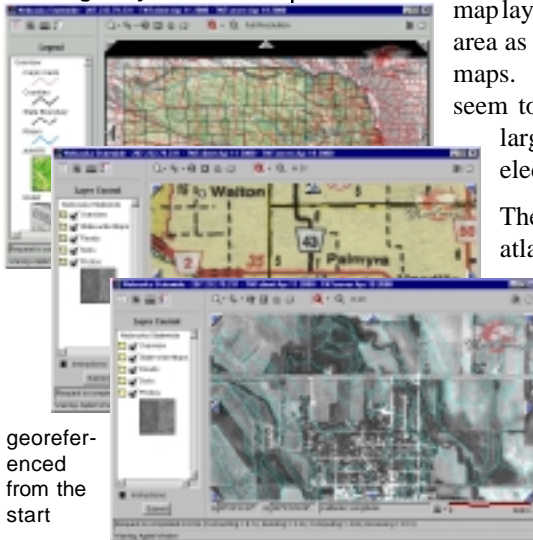Level 1 home page — takes you to Level 2 or directly to Level 3

Level 2 statewide Landsat — graphic index to Level 3

Level 3 single county SPOT — many over-lays available; link to Level 4

Level 4 topo maps and orthophotos — Level 3 overlays plus property maps

Geodata or Not
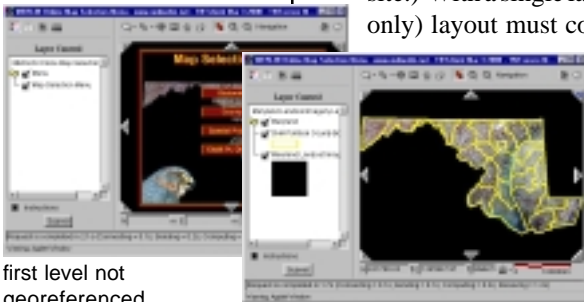
automotive products atlas

no georeference

single layout atlas

georeferenced from the start

hierarchical atlas

first level not georeferenced

An atlas can be just a collection of pretty pictures, but you lose many of the powerful features available when working with georeferenced materials, such as precise geographic overlay and the ability to make meaningful ground measurements. A purely graphical atlas is appropriate for some applications, such as a parts catalog or an electronic museum. However, when the atlas contains maps or imagery representing ground area, these objects should be georeferenced. In addition to precise geographic overlay of vectors on base maps, georeferenced objects can be used as a virtual mosaic. For example, the property map layers in MERLIN cover the same area as the original scanned property maps. If you display them all, they seem to be mosaicked into a single large property map, or you can elect to display just one or a few.

The first image in a hierarchical atlas is often simply graphical to introduce the subject of the atlas and provide initial choices for paths through the atlas. More than one graphical level may be found as you navigate your way to the geodata (see the San Francisco, CA sample atlas at MicroImages' web site.) With a single layout atlas, the initial (and only) layout must contain georeferenced images so the layers displayed can change by map scale as you zoom in and out (see the Nebraska Statewide atlas). A layout is any combination of images and overlays and perhaps annotation.

MERLIN Atlas Structure

MERLIN uses a hierarchical atlas structure with four levels: the Map Selection Menu graphic, the full state color composite Landsat image with county outline overlay, the individual county SPOT image with 13 groups of vector overlays, and the topographic maps and orthophotos with 14 groups of overlays. The groups in MERLIN's 3rd and 4th levels represent a number of overlays tied by a common theme. For example, the Sensitive Areas group contains fish blockage sites, critical areas, natural heritage areas, forest legacy areas, sensitive species project review areas, floodplains (100- and 500-year), and three types of wetlands if available for the county.

Initially, the only overlay turned on for viewing is the map quad (3rd level) or quarter quad grid (4th level) in the Base Maps group. You need to decide which of the other overlays you want to see, and turn on the check boxes next to those layers and click on the Submit button. On the 4th level, the USGS topographic maps provide the default base image. The CIR and natural color orthophotos are also in this Base Maps group and need to be turned on for viewing if you would prefer the orthophotos as the base image.

Each group can be expanded to show all the layers in the group or collapsed to show only the group name by clicking on the folder.
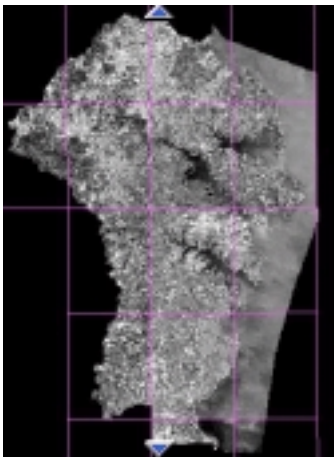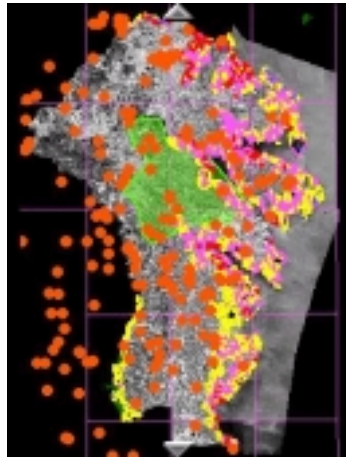

Default view
← (3rd level)

You choose the overlays you want, then click on the Submit button.

Selected layers in Sensitive Areas group on (3rd level) →

Publishing Atlases on the Internet

The **Project File** is TNT-mips' internal data structure. Any combination of geodata layers can be stored in a Project File. Layouts (see page 12) are also stored as objects in Project Files. The same Project File structure is used by all the TNT products on all computer platforms including Macintosh, Windows, UNIX, and LINUX. TNTserver provides access to objects in Project Files for TNTclient and TNTbrowser.

TNTserver will run with any level of Windows NT 4.0 or Windows 2000. The requirements beyond that depend on how much traffic you anticipate and how much data is associated with your atlas(es). MERLIN uses a 500 MHz Pentium with quad Xeon processors, 1 Gb of RAM, and an ethernet card to connect to multiple machines configured as RAID drives or file servers that contain all the data served.

TNTserver is multi-threaded, which means it can start simultaneous compute threads. Microsoft and Intel recommend for best performance with NT 4.0 that the number of compute threads be set at no more than one greater than the number of processors, or two for a single processor machine. The basic TNTserver supports two simultaneous compute threads and can be upgraded to support more compute threads if required by the volume of traffic at your site.

At MicroImages we host a variety of atlases. The machine configuration includes four 400 MHz Pentiums with 64 Mb of RAM, one 450 MHz Pentium with 96 Mb of RAM, and a RAID drive consisting of one Pentium Pro 180 with 64 Mb of RAM and six 30 Gb drives. Each of these machines has a 100 Mbit ethernet card and all are connected by a 100 Mbit ethernet switching hub. Each of these machines, except the RAID, runs its own copy of TNTserver. Two of the TNTservers run Windows 2000 and the other three run Windows NT 4.0 with service pack 4. The TNTserver system at MicroImages is similar to that pictured. Although the bottom of the line NT and 2000 will run TNTserver, a higher level is needed to configure multiple drives as a single RAID drive.

The system set up at MicroImages is similar to that shown below.

Raster Components

The Landsat imagery (level 2) is an 8-bit composite color raster with a ground resolution of approximately 30 meters. The SPOT imagery (level 3) is an 8-bit unsigned grayscale raster with 10-meter resolution. The topographic maps and orthophotos (level 4) are 8-bit composite color rasters. The topographic maps were scanned from 1:24000 scale maps. The orthophotos have approximately 1-meter resolution. The tax maps (also level 4) are linked to binary TIFF files with approximately 1-meter resolution.


Full view and full resolution of the Landsat imagery that comprises MERLIN's 2nd level.

All of these raster layers are large. For example, the topo maps vary somewhat in size but are around 6600 lines by 5000 columns or about 33 Mb if uncompressed. Even with compression, you can see that considerable disk space is necessary to maintain the files covering the entire state of Maryland. Using linked TIFF files for property maps promises easy update at some cost in display speed.
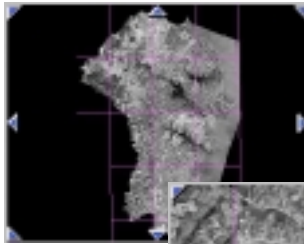
Full view and full resolution of the SPOT imagery that comprises MERLIN's 3rd level.
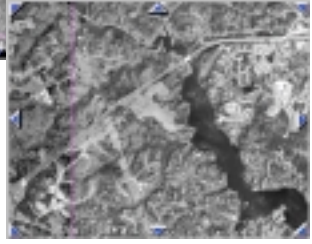
Topo map (left) and corresponding area of orthophoto (below, left) zoomed out 4X from full resolution.

Natural color orthophoto at full resolution and corresponding property map.

Property maps show as white lines on a transparent background.

Vector Components

The same vector overlays on the three types of base maps.

The Legend panel (middle and bottom) omits the show/hide components of the Layer Control panel (top) and shows a legend entry only for those layers visible in the current view.

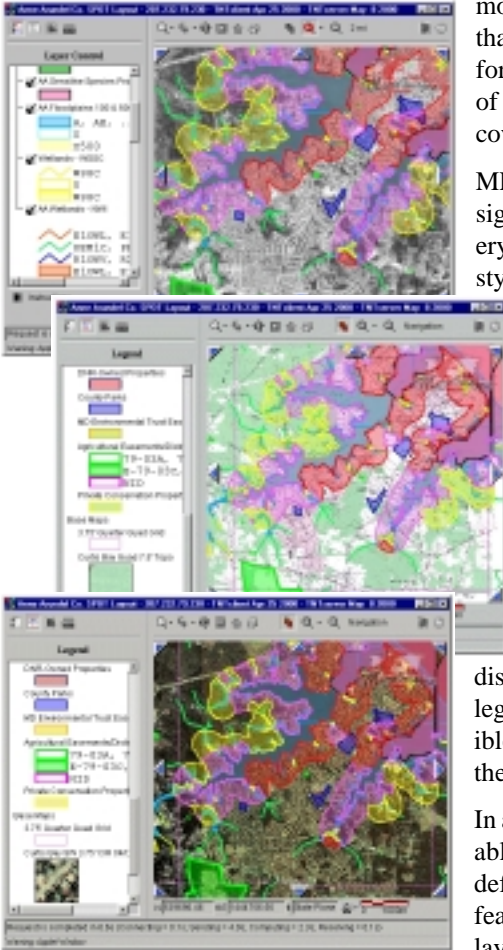The majority of the groups in MERLIN's county and quad level layouts contain only vectors. Even the two groups that contain raster objects have one or more vector layers. There are more than 70 vector layers to choose from for many locations. A complete list of layers is found inside the back cover.

MERLIN's vector layers are designed for overlay on the base imagery. As such, most polygon fill styles are semitransparent so you can see through to the base layers.

None of the vector layers except the map grids are on by default. To turn on additional layers, you need to have the Layer Control panel open. You then check the layers desired and submit the request to TNTserver. In addition to the overlays, you get a legend for each displayed layer. If you switch to the legend panel, only those layers visible in the current view will show in the list.

In a simpler atlas, it may be reasonable to have all the layers on by default. But, this strategy is not feasible for an atlas with myriad layers, such as MERLIN. In an atlas where all layers are visible by default, the atlas web designer may choose to eliminate the Layer Control panel so that the user does not have the ability to turn layers on and off and is presented with a simplified legend.
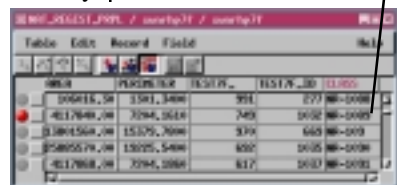
Database Components

MERLIN has a sizable database component that can be viewed when running TNTmips or TNTatlas, but is available for viewing only in InfoTips form when the atlas is accessed through TNTserver. The amount of database information available from TNTserver is determined by the atlas designer when setting up DataTips that are then available through the InfoTips panel in TNTclient or TNTbrowser.

There are actually two levels of database security that you can use. One is the simple security provided by TNTserver in which the outside world sees only the specific information allowed by the atlas designer, but anyone who has access to the data internally using TNTmips or TNTatlas can view the database information. This approach is appropriate when any employee with access to the system has clearance to view the database information, but you do not necessarily want all the database information available to the public. A higher level of security can be enforced for databases accessed through ODBC if the database software itself requires a password for access from ODBC. Atlases using ODBC cannot be distributed on CD-ROM, but are ideal for intranet or other multi-user situations.

InfoTips provide the database information selected by the atlas designer for all of the layers with elements near the location you click.
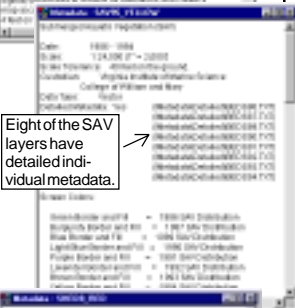
All of the numerous vector layers in MERLIN have associated database information. You can view all records in tabular form in TNTmips or TNTatlas and use the records to select and highlight the attached elements if desired. With the InfoTips proved by TNTserver, you only get information about a particular element if you have clicked on or near the element; you cannot peruse other element information as you can with an open table. However, you get that information for all layers with elements near where you click when viewing InfoTips.

Metadata

You have access to metadata by clicking the right mouse button on a layer name in the Layer Controls panel

Eight of the SAV layers have detailed individual metadata.

In TNTmips and TNTatlas, you get to the meta-data from the Tool menu.

Metadata is text that describes a layer. It may include such information as the date the data was acquired, how the data was acquired, the accuracy of the data, and so on. A metadata file can be unique for individual layers or can be shared by many layers. One approach used in MERLIN has generic metadata for a number of similar layers (Submerged Aquatic Vegetation layers for 11 years), which also provides the locations of more detailed text files describing each layer separately. In TNTmips, you select all the objects you want to associate with a particular metadata file in a single step (Support / Maintenance / Attach Metadata). This metadata can then be viewed whenever the object is displayed or selected in any of the TNT products.
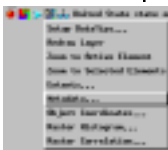
Most of the layers in MERLIN have associated metadata. You get to the metadata by right-clicking on the layer name and choosing *Metadata on Layer* in the Layer Controls panel of TNTclient or TNTbrowser or by choosing Metadata from the layer's Tool menu in TNTmips or TNTatlas.

Metadata appears in a separate window for you to read. You can keep this window open and refer to it while you do other operations. You can open multiple metadata windows and compare the information for different layers. Within TNTmips, you can also edit the metadata while viewing it.

You can edit metadata if using TNT-mips to view the layer. TNTatlas and the Internet products allow viewing only.
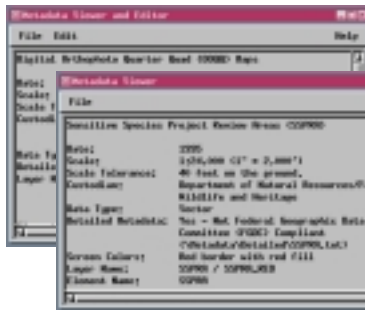
Including URLs as Part of Your Atlas

There are three methods for directing people to other web sites from within your atlas: the atlas designer may have created direct links within the atlas to specific URLs, URLs can be included in InfoTips, or the web designer can add buttons in the banner area that may link to web sites.

A link to a web site from within an atlas opens your browser of choice if not already open and takes you to the indicated web site. A direct link within the atlas from an index area or element to a web site may be confusing to someone not familiar with the particular atlas unless there is at least also one other link so they are prompted to choose. For such direct links you should make some effort to include information so the user knows they need to be connected to the internet to access some (or all) of the links.

The other two methods of linking to web sites from within an atlas are available only to those using the atlas with TNTclient or TNTbrowser. URLs included in InfoTips require a positive action on the user's part (click on Go button) to initiate the connection. Buttons in the banner also require an action on the user's part to initiate a connection, but it may not be as clear what they will be connecting to since the amount of descriptive text is limited on a button. Each banner button can connect to a single web site (or to some other atlas or external file). There can be a web connection for each layer represented in the InfoTips. There even can be multiple connections for individual layers if the InfoTips uses a computed field so that it finds all records attached to an individual element.

If an index element or area has more than one link, you get a selection window (a popup menu in TNTclient) to choose the link you want. You can also set the HyperIndex Options in TNTmips or TNTatlas so you always verify your selection, even if there is just one choice.
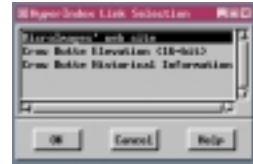
Currently in MERLIN, there is only a single InfoTips web link.

The Nebraska Statewide atlas has multiple web links for any location you click.

The row of buttons shown across the top of the Precision Farming atlas for Otoe County, Nebraska connect to a variety of files and web sites. The button graphics and links are specified in the HTML file that launches the atlas for TNTclient.

Other Applications for MERLIN

When the entire feature is visible, just use the measuring tool of choice and set the units to those desired.

For cumulative length, measure from one landmark to another, add the measurement to the total, then scroll and extend your measurements from where you left off.

You can generally expect that a system with such complete geographic coverage of a large area will be useful to people beyond those for whom it was specifically designed. Many of these uses will be obvious extensions of the original design. Other people will put the system to unexpected and innovative uses.

Easily anticipated uses include the environmental consultant seeking to advise clients on the permits required for development of a particular site or the commercial forester that needs to measure a customer's forest stand and include an aerial photograph of the site in a management plan report. Less obvious uses include the jogger who wants to look for alternate routes and measure the distance of a day's jog or the middle school student that needs to measure the length of the Baltimore Beltway for a geography class project.

As mentioned in the introduction, the strict management and quality guidelines enable all the geodata layers to work together for detailed local use. With all the data covering the entire state available from a single site, maps can be quickly produced for assessment and management of any environmental problem, such as hurricane, oil spill, toxic waste dumping, and so forth. And any new imagery gathered to document such problems can be immediately and easily introduced in TNT-mips and used with the existing MERLIN data for damage assessment and change mapping.
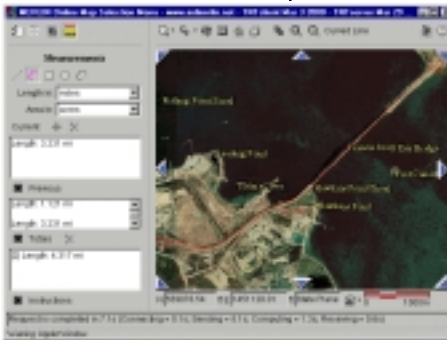
Detailed Hunting Safety Example

You've acquired permission from a property's owners to hunt deer on their land. They inform you there are no buildings, cattle, or other safety issues on the land. To insure the safety of other hunters or hikers, you will post the boundaries of the property as "no trespassing." Since the owners do not live on the property, they are uncertain what shooting hazards may exist on other adjacent properties, such as hunter stands, buildings, trails, and so on. You cannot readily determine this information either, so it is important to locate your stand where it insures the safety of others as well as your safety while maximizing your hunting experience and success. You decide this goal can be accomplished by locating your stand where a shot in any direction will not reach the posted property's boundaries.

Use MERLIN to help you. Navigate to the county of interest, then choose the appropriate 7.5' map quad. Turn on the property map overlays and the color-infrared orthophoto. (These are the two layers shown in the screen capture below.) The property map overlay (white lines) is somewhat hard to see in this small print against a wooded area as the images are "leaf-off" from early Spring. The property lines are quite obvious on your screen.

You know your gun's maximum range is 450 feet. You have seen deer most frequently near a stream just west of the property. Use the measurement tools to create a circle with a radius of 450 feet and move it around the western edge, always keeping it within the property. As illustrated, you choose the northwest corner as the best location. Place your cursor over the center of the circle, and read the coordinates of your stand. Finish up with a screen grab, and print out your image map in color. Take this with you to locate your stand and as a field map.
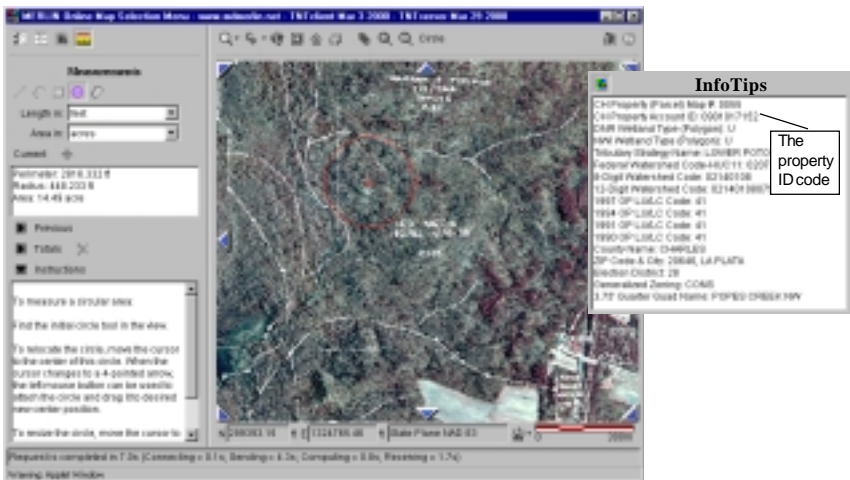
Comparison of Atlas Product Features

DataTips

database table

InfoTips

Any atlas you make can be used in any of the TNT products. The features available and files required for setup vary somewhat between products.

When you run an atlas in TNTmips, TNTedit, or TNTview you have all the features of the display process available. TNTatlas has a reduced set of tools—you cannot alter display parameters or create and save new data. You do, however, get all the features of the GeoToolbox except that sketches are only temporary and cannot have attributes assigned. The GeoToolbox is not available for TNTclient (and TNTbrowser) but simple and cumulative measuring is available. You can view database tables in TNT-atlas and create new forms for table viewing, but you cannot change existing records or add new ones. The only database information viewable in TNT-client is that selected as DataTips for the other TNT products, which appear in the InfoTips panel.
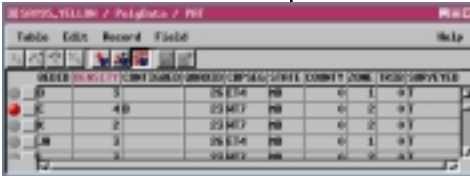
No special files are needed in order to start an atlas from TNTmips, TNTedit, TNTview, or TNTatlas. You do, however, need to know the object to select so that the HyperIndex links are available. When running TNT-atlas, you can also select a .atl file, which is created by the atlas de-signer to simplify atlas startup. When running TNTbrowser, all the information needed to launch an atlas is setup through the TNTserver Manager control panel when that server's atlas list is created. Launching an atlas with TNTclient requires an additional HTML file that sets atlas parameters such as background color, available tools and tabs, and what object to start with. Advertising banner parameters are also part of this file.

MERLIN's Geodata Layers

There are base maps at two different levels in the MERLIN atlas, the county level SPOT imagery (10-meter resolution) and the topographic maps and color-infrared and natural color orthophotos (1-meter resolution) at the next level. These two levels also have grid overlays showing the boundaries of the 7.5' topographic map quads and 3.75' quarter quads, respectively.

Layers for Base Map Overlay

Labels
    County Seats
    Place Names
    Stream Names
    School Names
    Hospital Names
    Airport Names
    Bridge Names

Real Property*
    Property Map Index
    Property (Parcel) Map
    Property Account ID
    Property Maps

* Real Property group layers and Wetlands (DNR) not available for overlay on SPOT base

Sensitive Areas
    Fish Blockage Sites
    Critical Areas
    Natural Heritage Areas
    Forest Legacy Area
    Sensitive Species Project Review Areas
    Floodplains 100 & 500-Year
    Wetlands (WSSC)
    Wetlands (NWI)
    Wetlands (DNR) in quarter quad pieces*

Protected Lands
    Federal Properties
    DNR-Owned Properties
    County Parks
    Environmental Trust Easement
    Agricultural Easement/Districts
    Agricultural Easement/Districts ('95–'99)
    Private Conservation Properties

Soils
    Chesapeake Farms for the Future

Historic Sites
    Inventory of Historic Sites
    Historic Trust Easements
    National Register of Historic Places

Watersheds
    Tributary Strategy Areas

Watersheds (continued)
    Federal Watershed Codes HUC-11
    Watersheds (sub-watersheds, 8-digit)
    Watersheds (3rd order, 12-digit)

Hydrology
    USGS Stream Gaging Stations
    Streams
    Changes in Shorelines
    Shoreline Boundaries

Aquatic Resources
    Submerged Aquatic Vegetation
        (1 layer for each of 12 years)

Land Use/Cover
    Land Use for 4 years

Recreation
    Boater Access Locations
    Greenway Corridors

Smart Growth
    Priority Funding Areas
    Rural Legacy Areas
    Brown Fields
    Designated Neighborhood
    Empowerment Zones
    Enterprise Zones
    Heritage Areas
    Home Loan Boundaries
    Hot Spots
    Live Near Work
    Main Street Communities

Infrastructure
    Power Generating Stations
    Wastewater Treatment Plants
    Road Centerlines
    Electric Transmission Lines
    Gas Pipe Lines

Political
    County Boundaries
    ZIP Codes
    Election Districts
    Generalized Zoning

Advanced Software for Geospatial Analysis

MicroImages, Inc. publishes a complete line of professional software for advanced geospatial data visualization, analysis, and publishing. Contact us or visit our web site for detailed product information.

TNTmips   TNTmips is a professional system for fully integrated GIS, image analysis, CAD, TIN, desktop cartography, and geospatial database management.

TNTedit   TNTedit provides interactive tools to create, georeference, and edit vector, image, CAD, TIN, and relational database project materials in a wide variety of formats.

TNTview   TNTview has the same powerful display features as TNTmips and is perfect for those who do not need the technical processing and preparation features of TNTmips.

TNTatlas   TNTatlas lets you publish and distribute your spatial project materials on CD-ROM at low cost. TNTatlas CDs can be used on any popular computing platform.

TNTserver   TNTserver lets you publish TNTatlases on the Internet or on your intranet. Navigate through geodata atlases with your web browser and the TNTclient Java applet.

TNTlite   TNTlite is a free version of TNTmips for students and professionals with small projects. You can download TNTlite from MicroImages' web site, or you can order TNTlite on CD-ROM with the current set of *Getting Started* booklets.

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MicroImages, Inc.

11th Floor – Sharp Tower
206 South 13th Street
Lincoln, Nebraska 68508-2010 USA

Voice: (402)477-9554   email: info@microimages.com
FAX: (402)477-9559   Internet: www.microimages.com