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Introduction

MicroImages is pleased to distribute **V6.50** of the **TNT** products, which is the 50th release of **TNTmips**. This is the longest interval between the 50 releases, but it has produced many new major features. A count of 163 new feature requests submitted by clients and MicroImages' staff were implemented in **V6.50** processes. A summary of many of the new features is listed below.

- **TrueType Interface:** The X server and all the TNT interface components use any convenient TrueType font, size, and styling available in your language.
- **Virtual Desktop:** Create a large X workspace much bigger (for example 4000 by 4000 pixels) than the monitor's real view. Instantly move the real view to any area of the workspace with positioning tools provided in the new small Workspace Overview window or by using scroll bars.
- **Large Display Windows:** Open large 2D or 3D display windows in the workspace (for example, 4000 by 3000 pixels) big enough to hold the entire extent of a composite view at full resolution. Open it to view at a specified scale such as 1:24,000. Instantly move real view to see any area.
- **3D Polygons:** Select polygons and extrude them into solid shapes in 3D views. Control their height by a field, even a computed field, in attached attributes. Control the fill of top and sides by separate styles. Control shading by sun position.
- **3D Raised Symbols:** Raise point symbols on stalks above the surface and out of the clutter in a 3D view. Stalk height and style are set by attached attributes.
- **Edit Large Areas:** Open a large 2D display window for detailed editing over large areas of any composite view (for example, over an entire LANDSAT image or an orthophoto quadrangle with DLG overlays at full resolution).
- **Save/Restart Edit Sessions:** Save a layout for an edit or display group. Load the group later to reopen the large edit or display session with all its components and settings.
- **Snap Between Layers:** When lines are created or edited, snap them to elements in any other vector layer.
- **Redo:** Reverse the last undo operation on any layer used in the edit session.
- **Multiple Buffer Zones:** Create multiple buffer zones in a single pass with correct topology. Specify equal increment zones or enter a list of distances. New options for handling island buffer zones are available.
- **Automatic Raster Combination:** Combine multiple rasters into a single raster object whose cells contain a unique value for each combination of input cells. This process is equivalent to the Automatic Raster Combination procedure in other products.
- **Multi-Criteria Decision Analysis:** Use a GeoFormula Wizard to define a new raster that is a weighted combination of several input rasters and vectors.
- **Faster Object Creation/Selection:** Selecting objects or creating new objects in Project Files with 100s or 1000s of objects is much faster.
- **Label Along Curves:** Position a label above, on, or below a selected curved line element. The jagged line inflections or their spline can be used as a base line.

- **Save Sketches:** Save field drawings, tracings, image interpretations, GPS routes, … made for any layer in a free **TNTatlas** can be saved as CAD objects for use in other **TNT** products.
- **Inspect Files:** Display the contents of unknown geodata files to search for header, layout, problems, or other characteristics.
- **Protecting Atlas Content:** Specify during the creation of an atlas which **TNT** products can use its contents. For example, a **TNTatlas** can be distributed on CD that can only be used by TNTatlas, which has no export features, thus protecting its contents.
- **Dynamic Atlas Links:** Use database records to compose links from features in an atlas that start other non-TNT applications via file names or access a specific web site's content by URLs. These links can be formed by computed fields. They can be dynamic locations since the database can be changed by other software independently from the atlas structure and elements.
- **TNTatlas for Windows: TNTatlas/W** is a new native Windows application for distribution with and viewing of atlases. It does not use the X server. It can be used with exactly the same atlas as **TNTatlas/X**. It can be internationalized by translating the TNT resource files. It supports some Windows features not available in X, such as docking, quick open,...
- **Real-Time 3D Simulation: TNTsim** is a native Windows application that provides real time 3D simulations (15 to 60 frames per second). Input is from any Project File using a raster object for relief (an elevation layer) while draping another raster object over it for overlay (an image layer). Flight control is by joystick or keyboard.
- **Legends:** Use a new color scale range legend for rasters in LegendView or layouts. Mix text fonts, styles, and sizes in a legend. Add tabs for multiple column legends.
- **MGRS:** Select the Military Grid Reference System for coordinates input to reposition a display view or for readout of the cursor position.
- **Movies:** Use 30 new **SML** functions/class methods to write scripts to generate MPEG or AVI movies frame-by-frame with dynamic inputs and flight paths.
- **TNTserver:** TNTserver can now evaluate, grade, and return results from fuzzy queries that have no exact match. A client request for printing the atlas's view can now return a convenient HTML layout that can be printed, saved, and modified.
- **HTML-based TNTclient:** This client has the same functionality as the Java-based TNTclient. It is smaller and faster for phone modem access. Its users can select from preprogrammed queries stored on the general web server. It uses HTML for easy construction of the forms (web pages) for user query input.
- **TNTclient:** All TNTclients now handle the return from fuzzy queries, support printing via HTML layouts, and permit theme selection.
- **QuickGuides:** 11 new QuickGuides are available.
- **Getting Started Booklets:** 4 new Getting Started Booklets are available.

Installation

When MicroImages produces the TNT CDs for a particular version (for example, V6.50) they contain authorizations for the registered upgrades for each specific key. Simply install your products using the normal procedure and begin using them immediately. You do not need to contact MicroImages for any kind of authorization code.

You need to obtain an authorization code only if your TNT upgrade was ordered after the CDs were produced for the desired version.

It is also important that you install your TNT product from the CD to insure that all the correct components, drivers, modules, browser types and versions, … are actually installed. There are now many variants of Microsoft Windows products, editions, and patches (in many combinations). Thus, moving a TNT product by merely copying the TNT product folder is not reliable, as the management of the required Microsoft libraries during installation has become complex and critical.

Dropping Product

From the date of this MEMO, single processor or floating licenses will be the two types of licenses available for the TNT professional products.

MicroImages has stopped selling multi-user, single processor TNT licenses.

Effective immediately the multi-user, single-processor license is no longer available for the TNT professional products. This license was used to permit a single computer to allow more than 1 remote user to connect to it via the X server running on any other networked computers. Each remote user/connection was able to start an independent copy of a TNT product on that same, single computer. For example, a 3-user license would permit 3 remote users to start up the X server and run 3 different copies of the TNT product on a single computer to which the key was attached.

Multi-user, single-processor software products are now historical and only work well on the big, expensive UNIX-based platforms that could service many simultaneous users. Unfortunately, the lower cost of this kind of TNT license attracted people to buy it and attempt to run it on a low-cost desktop computer with minimum memory, a single processor, and an operating system not designed for such tasking. Floating licenses are more expensive but are much more flexible when used for multiple users.

Since this is simply a licensing change, MicroImages can and will continue to issue new upgrades for clients who have multi-user, single-processor licenses.

Hardware Keys

Key Tags.

For the last month, all new and replacement TNT product keys have been shipped with a new key chain attached. This 10 centimeter piece of light chain attaches a heavy duty

plastic luggage identification tag to the key. This tag identifies your product, key, ownership, and shows MicroImages' contact information. The new, small USB and parallel keys represent your considerable investment and can be easily misplaced or lost. If you can leave the plastic ID tag attached, it will help you and others identify the presence and value of your product. If you routinely move your key from machine to machine, lend it around, or take it home, these key chains will help you keep track of who has your product.

USB keys.

The new USB combination keys programmed for your use with Mac OS and Windows are quite convenient and reliable. If you wish to upgrade your parallel key to a USB key, this can be done for a cost of US$100, which includes return shipment by DHL.

Parallel Keys.

New beta drivers for the parallel port key for Linux were provided to MicroImages by their manufacturer just after V6.50 was finished. The principle change in these new drivers is better support for their use on LINUX computers using multiple processors and the latest kernel (V2.4). MicroImages is working with these drivers at this time. Contact software support for further information if you are affected.

Platform Specific News

Mac.

Mac OS 9.1.

V6.40 and V6.50 have required no alterations to run with Mac OS 9.1. No obvious changes can be seen between 9.0 and 9.1. It appears that 9.1 was issued primarily to fix errors and to insure its operation in classic mode under Mac OS X.

It has just been discovered that using any version of the TNT products under 9.1 requires that you install and select the extension for Speech Recognition (English). If you do not use this extension, your TNT windows will behave erratically. Please note that this must be the English version of Speech Recognition. For example, it will not help to merely turn on the equivalent extension provided with the Japanese Mac OS 9.1.

Important Note! You must have and turn on the Speech Recognition extension to operate any V6.50 TNT product under Mac OS 9.1.

At this time MicroImages does not know why this odd extension is needed for proper TNT operation. Please simply use it and/or check with software support for any further information on this weird situation.

Mac OS 9.2.

MicroImages has experimented with the alpha version of Mac OS 9.2 code named Moonlight (V9.2a4). The TNT products run as usual under V9.2 but still require the English Speech Recognition extension to be turned on.

Mac OS X.

MicroImages has tested V6.50 of the TNT products running in classic mode under Mac OS X and experienced no additional difficulties. Classic mode is where you also install Mac OS 9.1 or 9.2 and use it from within Mac OS X. If you are planning to run TNT products in this fashion, please use only Mac OS 9.1 or 9.2 and V6.50 of your TNT product.

MicroImages is just beginning to experiment with Mac OS X to determine when, how, and if it will be supported by the TNT products. If the TNT products become available as X server-based applications under Mac OS X before the release of V6.60, it will be announced on microimages.com.

Why couldn't Apple simply use the number 10 instead of Roman numeral X? Their use of X will be very confusing to everyone in their materials promoting its UNIX core when they do not provide any X server support. One can only surmise that they deliberately intend to confuse us for some marketing objective. However, it will be doubling confusing to those who use TNT or MI/X products!

Identifying Sloppy Extensions.

Almost all special problems experienced on a specific Mac, including those with TNTmips, can be traced back to a bad extension installed by some 3rd party software or Apple. Typically, a software vendor will install an extension that has been tested with a few popular programs and find that it conflicts with an extension provided by some other 3rd party. A recent test installation of a wireless PC card on this Mac added 4 extensions and a control panel. The Apple extension "Sound" is currently turned off on this 9.1 based Mac as it is known to produce erratic behavior in the desktop in combination with some other unknown extension.

MicroImages does not patch your Mac OS by installing any extensions. However, the TNT products do heavily utilize system resources that can also cause conflict with sloppy 3rd party extensions. In every case encountered at MicroImages to date, the extension at fault has subsequently been repaired by its vendor as other applications also conflict with it.

It does take detective work and patience to track down an extension conflict. There are now hundreds of extensions, it takes considerable time to restart, the test illustrating the problem must be performed, and thus isolating the bad extensions is slow. Adobe has the same problems with their big applications and their following report is very useful. It presents the procedures they recommend to trace down the offending extensions so they can be removed until repaired or, if needed, confined to a special boot up mode. See http://www.adobe.com/support/techdocs/497a.htm for the report Disabling Extensions and Isolating Extension Conflicts in Mac OS 9.x or 8.x.

HTML-based TNTclient.

The new HTML client has been carefully tested at each development stage with various operating systems. It functions smoothly and almost identically on a Mac or Windows with Internet Explorer or Netscape.

LINUX.

Red Hat Kernel 2.4.

MicroImages has installed and used V6.50 of the TNT products on Red Hat 7.1, which was just released in late April for V2.4 of the LINUX kernel. V6.50 also runs as before with the previous versions of the LINUX kernel (back to at least 2.0.36).

SUSE Kernel 2.4.

MicroImages has installed and used V6.50 of the TNT products on SUSE 7.1, which was released several months ago for V2.4 of the LINUX kernel. V6.50 also runs as before with the previous versions of the LINUX kernel (back to at least 2.0.36).

Dual Booting

You may wish to install a version of LINUX on the same platform as Windows. Information on this procedure can be found in the following article.

Installing Windows and Linux on a single machine is much easier than it used to be, but it's not quite a no-brainer yet. 2 November 2000. PC Magazine. pp. 102-104.

You will find this useful article on the web at
www.zdnet.com/pcmag/stories/solutions/0,8224,2643483,00.html.

Once you can dual boot, you can boot into either your Windows or LINUX operating systems. This will enable you to experiment with the LINUX performance of your TNT product and support of your peripherals while still completing your production work and using other software in Windows. You can then learn LINUX and sort out any legacy issues as time permits.

You can only use this dual booting with parallel TNT product keys. Unfortunately USB support is only unofficially and incompletely provided at this time by LINUX and drivers for your legacy peripheral devices are unlikely to be available. If you are using a USB key for your TNT product you could install TNTlite on the LINUX side. Remember, TNT Project Files are transparent and can be interchanged and used in either version of TNTmips.

Editorial and Associated News *[by Dr. Lee D. Miller, President]*

Buyout News.

ERDAS sold! - ENVI sold!

ENVI and its parent, Research Systems Inc,. were purchased by Kodak several months ago.

ERDAS was just purchased 100% at the end of April by Leica Geosystems headquartered in Heerbrugg, Switzerland. Leica Geosystems also purchased the balance of LH (Leica Helava) from BAE Systems. Leica Geosystems is one of several different Leica International companies. Details on this purchase can be found at http://www.leica-geosystems.com/investor/news/erdas_lh.htm. One common thread in the 2 purchases is that Leica Geosystems has a long history of manufacturing surveying and analog photogrammetric equipment. Their product mix can be reviewed at www.leica-geosystems.com and is strongly oriented toward data collection. Both of these new purchases brought Leica suites of expensive, complex soft photogrammetry products that dovetail with their current product mix.

ENVI and ERDAS now gain access to much larger marketing and sales organizations. In any given nation, the products of these larger parent companies have many competing sales locations. There is a tendency for large organizations to institutionalize the smaller companies they buy. These purchases leave many questions to be answered

by future events. For example, what does this mean for the existing dealers for these smaller companies that have often enjoyed at least defacto exclusive status in a nation? What will be the future of the long term relationship between ESRI and ERDAS under this new ownership?

Special Academic Licenses.

MicroImages has set up a new program for institution-wide academic use of all the TNT professional products including the TNTserver. The details on this program for use of these products in teaching geospatial analysis are described in a MicroImages MEMO entitled Special Academic License for TNT Products dated 3 January 2001. This MEMO has been sent to all MicroImages clients at institutions that might be engaged in the teaching of geospatial analysis. These materials were also provided to MicroImages' Authorized Dealers for their translation and distribution. They can be reviewed by anyone at http://www.microimages.com/prices/sal.htm.

New Dealers.

Soon after the shipment of V6.50 is complete, MicroImages will begin to aggressively campaign to recruit new dealers from within our client base and elsewhere. This activity will focus on selected nations and upon disciplines not currently well covered. We would be happy to have your input regarding any potential dealer in your nation.

New Features.

Virtual Desktop.

Everyone has spent time with large paper maps and photo prints. We like to use them, hate to fold them, and have lots of trouble finding or storing them. We like to find the right map and study how we will get from here to there and what we will see along the way. We make good and extensive use of the spatial context in the large, complete, detailed printed map or image. When we look at the same material in digital form through the tiny porthole of our monitor, we lose the overall context and the interrelationships between features. As the saying goes, "we can not see the forest because of the trees."

Someday, in the not too distant future, we will have large-sized, high resolution digital displays. They may be flexible and simply rolled out of a tube like a window shade. At that time we will regain the ability to overview and quickly study our geospatial materials. Alas, these devices are likely to be expensive at first unless driven by other user demands such as digital wall pictures, digital simulated windows, or some other wide commercial use. With the virtual desktop released in V6.50, and earlier changes in the TNT products, the X server provides the ability to use larger and larger displays and multiple monitors to gain back some of the value of viewing in context. However, for the time being, we must still pan our monitor, our real view, from area to area. Since this is essentially instant with MicroImages' new virtual desktop, some of the value of the context presented in large maps and images is retrieved.

This is a feature I wish MicroImages could have brought to you years earlier. Until recently you just didn't have the processing power and resources to support this approach in your desktop machine. Now you do, and now you have it. You can use it to load whole orthophotos, maps, LANDSAT scenes, or complex overlays into your new, large View window and instantly scroll your real view to any area in it. You could already conveniently and quickly move to, or zoom up on, an area of your geodata using TNT's pyramid and tiling schemes and optimized vectors. But, this was not of much help in the

editor when you wanted to draw a large polygon spanning several real views at a zoom/resolution suitable for the required spatial detail.

There is some controversy at MicroImages about whether and how you will use this new capability. We almost installed the TNT products with a large virtual desktop—in other words, an X server larger than your Windows display settings. In the end we decided to wait until V6.60 for this.

Your interaction with, and use of, large View windows still needs some polishing and automation. At the moment we await your reactions before improving and streamlining this new visualization concept. For example, you may simply want to set up a display mode where every object you select automatically enlarges the View window to fit the object's extent at a set scale. We already have several similar ideas, and perhaps you have some as well.

Geospatial Visualization.

Anyone doing serious geospatial analysis is trained, or rapidly becomes experienced with visualizing how things look and interrelate in a 2D view. You read topographic maps, study topography, read airphotos and recognize trees from the crown shape, view LANDSAT images and recognize land cover types, and use many other similar geospatial skills. However, often the people you work for have other interests and do not have this training or experience. 3D visualization of your complex spatial materials can help them understand your results and explanations.

You already had several different ways of visualizing complex geospatial materials in the TNT products: 2D, static 3D, MPEG movies, TNTatlas, and TNTclient. All these use the same Project File geodata storage system. V6.50 introduces significant improvements in all these approaches and adds TNTsim as a new procedure.

- 2D View windows can now be much larger and viewed to scale.
- 3D View windows can now be much larger and polygon shapes can be extruded into these views with structure, color, and shading. 3D pinmaps can be displayed above the surface and connected to it by stalks.
- MPEG movies can be generated by **SML** scripts permitting variable geodata, sensor inputs, and paths.
- A faster, smaller, TNTatlas for Windows has been released.
- TNTsim has been added to fly through sites using a joystick or the keyboard.

All of these tools will continue to receive improvements. None of these are perfect, but they are designed specifically to work with your geospatial materials. One of the special requirements of these tools in geospatial analysis is going to be how well we can tie them together in the future. Some of the important interactions are already in place.

- 2D views can be geolocked and provide tracking cursors.
- Use a tool in a 2D view to set the viewpoint of a 3D view.
- A 3D vector can be followed as a flight path for an MPEG movie.

Other interconnections will need to be added to provide important synergy for the visualization of geospatial materials.

- A common flight path could be recorded and used from a real-time TNTsim, an MPEG movie, and elsewhere.
- Trace the flight path of a TNTsim on a 2D view.
- Choose a position and view in a TNTsim to spawn a much higher resolution 3D poster view.

- Automatically create a real time simulation for a vector path, such as the optimal network path between 2 points.
- Request a 3D view in an online or CD atlas.

I am sure you will get other ideas as you work with the current visualization processes, so let us know about them.

Flight Simulator.

As you begin to introduce simulation and a joystick into your geospatial products, you might benefit by acquiring a copy of Microsoft's Flight Simulator. It is a product that has been around for many years, is very low priced, and is built upon their DirectX. Learning to fly with a joystick does take some practice, and this is a good way to get it. What Flight Simulator has to offer that is unique is the performance characteristics and instrumentation of many airframes. TNTsim is not an airplane simulation and lets you violate the rules of aerodynamics. Perhaps it would be useful if one could use Flight Simulator to fly a particular aircraft or other set of constraints, save the path, and then have TNTsim or an **SML** MPEG script repeat the path with your geodata. Alas, as yet we have not determined if and how Flight Simulator saves a flight path and its parameters. Maybe some of your have?

Wavelet Compression.

Background.

Several months ago the previously reported legal contest between LizardTech (MrSID compression) and Earth Resource Mapper (ECW compression) was settled. The following is a portion of a report on this topic: ERM, LizardTech – Summary Judgment as reported in Geospatial Solutions, January 2001, page 12.

"The legal wrangling between Earth Resource Mapping (www.ermapper.com) came to an abrupt end in December when a federal court issued a partial summary judgment ruling that Earth Resource Mapping's Enhanced Compression Wavelet (ECW) technology does not infringe on LizardTech's MrSID (multiresolution seamless image database) patent."

"The United States District Court for the Western District in Seattle, Washington, granted ERM's motion for the ruling. The ruling follows the October issuing of a Notice of Allowance – an indication of patent approval – *for ECW technology by the United States Patent and Trademark Office."*

JPEG 2000.

MicroImages has been waiting for a resolution of this matter and the introduction of a public domain approach via the wavelet compression standard JPEG 2000 (also called JP2). The JPEG 2000 specification was adopted and issued a year ago but no viable libraries have yet emerged that could be licensed. There are additional extensions of the initial specifications to be approved as part of an additional level of standardization. These have to do with television applications and have little to do with our applications.

MrSID and ECW.

MicroImages has decided, since the court did not, to punt and support both existing formats. Effort has already started to add the capability to use MrSID files. Next will come ECW. Both should be supported in V6.60 of the TNT products.

Be very clear that these initial steps have to do with using files in these formats in TNTmips (display, import, …), not creating them (export)! Both companies have marketing strategies that allow you to have and use materials in these formats, but require large per unit license fees if you wish to write out your images in their formats. One strategy that might work in the TNT products would be for MicroImages to provide the interface (the API) needed to use their compression libraries. You could then license whichever one you choose directly from them to export to that format.

Avoid Conflation.

What Is It?

Now a word about conflation. Conflation, like inflation, is easy to cause and gives you lots of trouble later on. Random House Unabridged Dictionary defines it as *1. The process or result of fusing items into one entity; fusion; amalgamation. 2.a. the combination of two variant texts into a new one. b. the text resulting from such a combination.* Conflation is what you get when you try to merge 2 vector objects from different sources that contain many common features.

Can You Catch It?

As you create and edit more complex geodata layers you will learn the hard way about conflation, the nemesis of vector-based GIS and its topological requirements. It is encountered in many different situations, all of which result from combining layers with what are supposed to be common features. The lines making up the elements of the same features common to both objects will each cross at many points causing 1000s of sliver polygons. The attributes of the identical feature in each object may not have the same fields and may change attributes at different positions in the line.

Can It Be Cured?

Your problems of conflation can result from many sources and often can only be resolved with considerable effort using a complex spatial data editor, of which there are few. Because every serious conflation problem is different, there is no way to devise rules to automatically resolve the many topological issues involved.

Carefully plan out how to use the TNT tools to preprocess your objects to avoid conflation when they are combined.

Queries on attributes can be crafted to suppress lines from 1 of the objects. Before combination, new objects can be prepared for each original object using a series of queries that suppress features that will eventually result in conflation problems (for example, suppress the road network from the older object). Of course, this can be done with a more complex query during the combination. However, it is often easier to think out, test, and then apply a series of queries to filter down your objects prior to their combination. If you make a combination that yields many conflation problems, rethink what could have been done to preprocess the input objects to avoid them. Starting over to filter the input objects may take less time than pushing on to resolve your new object's conflation issues.

Once you have done all you can in advance and made your combination, there are filters in our Spatial Data Editor that can be applied to resolve common cases. More can

be added as repeated or generic cases are encountered and reported. These can be used to take care of a large number of the problems, but in the end you still have to manually check over your results and fix the special cases with the edit tools.

What About Serious Cases?

The pan-by-query capabilities in the Editor can be very useful to help you find, inspect, and fix the special cases that only your human computer can resolve. This is a very useful tool that you should understand how to use if you are doing a lot of editing. You can find more information on this topic in your Getting Started Booklet entitled Building and Using Queries and the online Reference Manual. This tool will pan to individual locations of possible problems, so that you can use the manual or automated tools to resolve them. If the vector object is overlaid upon a reference image, such as an orthophoto, it will provide the information that your human computer needs to determine how to resolve the specific case.

Almost .5 meter Imagery.

"EarthWatch Alters QuickBird 2 Plans. Satellite Gets 61-Centimeter Resolution. by James Bates. Space NEWS, March 26, 2001, front page story." [extractions from this article are provided below]

"By lowering the planned orbit of its QuickBird 2 satellite, EarthWatch Inc., Longmont, Colo. aims to offer images sharp enough to distinguish objects as small as 61 centimeters across [.6 meters], a capability its competitors will be unable to match for at least three years, the company officials said."

"QuickBird 2 also is equipped to take color images, and the lower orbital altitude will improve the resolution of those pictures from 4 to 2.5 meters Satterlee said."

"The key to EarthWatch's new plan is to place QuickBird 2 in a 450-kilometer rather than a 600-kilometer orbit as previously planned, Satterlee said."

"The lower altitude is not expected to reduce QuickBird 2's projected life span of five to seven years, Satterlee said. Placing the satellite in a low enough orbit to collect half-meter resolution data would have cut its lifetime by more than half, he said. The atmospheric drag on satellites increases as their altitude decreases."

"The U.S. government recently gave Space Imaging and EarthWatch permission to launch satellites capable of taking pictures with half-meter resolution."

"QuickBird 2 is now slated for launch in October aboard Boeing Co.'s highly reliable Delta 2 rocket."

Soft Photogrammetry.

Updating image and vector databases with orthoimages and 3D visualization are becoming popular applications of geospatial systems. Unfortunately, free or low-cost, high resolution orthoimages used in these processes are only available "off the shelf" for limited areas of the world. As a result, many of you are looking for a means to produce these base materials from some low-cost input stereo images that are already available to you, or from more complex, high-cost, specialized imaging systems (for example, hyperspectral devices).

MicroImages is receiving questions regarding the extraction of DEMs from a wide variety of imaging devices and the use of DEMs to correct the unique geometry of these source images. Unfortunately, there is no inexpensive, casual approach to your desired

result hiding in TNTmips or, to the best of our knowledge, in any other competitive general purpose, low-cost, desktop geospatial analysis software package.

The extraction of high quality DEMs and accurate orthoimages require:

1) access to many technical details about the imaging system,
2) costly special purpose software designed specifically for that sensor, and
3) very specialized technical training for the application.

Every single imaging device, with the possible exception of a standard calibrated airphoto camera, has its own geometry, distortions, ephemeris characteristics, …

Many different sensing and analysis approaches are being experimented with and tested for the production of DEM and orthoimages. As a result, each of you need and request a highly technical solution tailored to fit your unique imagery. In addition, you would like it to operate nearly automatically with a minimum of training and effort. MicroImages has gradually learned that low-cost, generic software approaches are not going to work well for this kind of situation. It represents a type of software application where the technical approach must be carefully tailored to a single or relatively unique situation. This is why the price of professional software for this purpose remains very high. As a result, the best solution to the extraction of DEMs and orthophoto production is going to come from the manufacturer of that system (aircraft or satellite). In fact, their image or other acquisition system will be measured by how well they produce DEMs or orthoimages. While they may not be willing or able to produce or sell these products cheaply, the clear trend is that you will buy or contract for the best products of these kinds directly from the manufacturer/operator of the acquisition system and their authorized technical partners.

The purpose of TNTmips is to perform geospatial analysis. It will not be able to assist you in reaching your specialized photogrammetric objectives to extract DEMs or produce orthophotos from a wide variety of images, except where your objectives can be addressed via the **SML** or TNTsdk extensions. There may be other specialized soft photogrammetry products that can assist you in your application. However, good generalized solutions to this class of applications are oriented toward production work and are expensive. Low-cost products that claim to provide generic application to many sensor systems should be carefully reviewed with skepticism. MicroImages does not do production work or use any such products and, thus, is not in a position to advise you as to which soft photogrammetry product to purchase.

CIR/RGB/Multispectral Camera.

Introduction.

Personal collection of color-infrared images has long been a goal of many MicroImages clients. This has been especially true recently as precision farming applications expand and use CIR images to estimate canopy biomass and detect anomalies. Agricultural images must be collected at the right place and at multiple times during the growing season. CIR film has proven hard to obtain, hard to properly expose, and difficult to reliably process. Precision farming applications can not be met by current satellite systems and mapping camera programs. Multiband camera systems (usually with 4 cameras) have been hard to accurately co-register, but are gradually improving and provide a sensor for this kind of image acquisition.

New Option.

A single lens CIR camera using internal beam splitters/filters is now available for use in an aircraft for direct, on-board digital recording of CIR images. This is the DuncanTech model MS3100 3-CCD Camera that has a resolution of 1392 by 1040 pixels (see www.duncantech.com/area_scan_cameras.htm). The spectral range of the CCDs used in this camera is about 400 to 900 nm. Filters can be swapped in and out to convert the camera's operation to natural color or other spectral band combinations in this interval. Its images are captured in-flight using a small computer equipped with a frame grabber board. For this card the PC must have a PCI bus slot, which eliminates almost all portables from consideration. Sample CIR images taken by this camera, including some agricultural scenes, can be viewed at www.duncantech.com/Gallery_Index.htm.

Images can be collected by the MS3100 at a maximum rate of 7.5 frames per second. However, practical applications acquiring these images in a continuous fashion require that they be offloaded and stored as collected. A cost effective method would be to use IDE hard drives installed in plug-in trays (US$20 per tray) and swap in 80 Gb hard drives. DuncanTech has noted that using a hard drive to record the images would produce a practical frame acquisition rate of 1 image per second. Since an uncompressed MS3100 image would be about 4 Mb in size, each 80 Gb drive at US$250 could store 20,000 frames. Under these circumstances, it would be practical to simply leave all original, uncompressed frames on the removable drives in trays as an archive copy.

DuncanTech has indicated that a complete MS3100 camera system, including their recommended frame grabber board and capture software, would be about US$14,000. This does not include the computer or the mounting framework on the aircraft. Since MicroImages does not collect any primary geodata, this camera is being brought to your attention based only upon its paper specifications and their sample CIR images. At least one TNTmips site outside the United States has just taken delivery on an MS3100 for use in agricultural applications and their reactions will be reported in a future MEMO. In the meantime, their name and contact information will be provided upon direct request for those who wish to make earlier personal contact with them.

X Server

Significant new features are being released in the Windows version of the X server provided with V6.50. These include a virtual desktop using an X window bigger than your physical display, direct support of TrueType fonts, and support of the X11R6.4 standard (V6.40 was X11R5).

Background.

The X server used with the TNT products has also been sold separately for general public use under the name MI/X 2.0. Starting on 4 May 2001, MicroImages began distributing a new MI/X 3.0 with similar features to those described here. MI/X 3.0 can be downloaded by anyone and tried free with their applications for 15 days. For several years there have been an average of 1250 trial downloads of MI/X 2.0 per week from microimages.com and uncounted others from many mirror sites that also provide access to it.

Many who download MI/X do not understand what an X server is and how, if at all, to apply it in their situation. As a result, only a small percentage continue on after the trial to license and purchase its continued use for US$25. However, this worldwide, wide-scale use and experimentation with MI/X has identified weaknesses, principally in the area of its compatibility with a few other popular X-based application programs and its

direct setup for these applications. Based upon that input and your comments, a significant number of advancements have been added to V6.50 of our X server for use with Microsoft Windows.

Our separate licensing of MI/X at such a low cost may appear to be of incidental importance to you. However, its minor economic value to MicroImages has provided resources and the incentive to make significant improvements in our X server including some important changes related to its use with the TNT products. The following introduces the significant new features for use with V6.50 and others are planned.

*** Virtual Desktop.**

What is it?

The concept of a virtual desktop has been added in V6.50 for use with all X-based TNT products running under Windows (for TNTmips only, this does require display level M50). To set up a virtual desktop you can now set the size of your X server to be much bigger than your monitor(s) real view. The attached color plate entitled Large Workspace and View Windows introduces the basic features of your new TNT virtual desktop. TNT windows and dialogs can be opened in this large workspace and positioned anywhere within it. Display windows, both 2D and 3D, can now be much larger than your real view. For example, you can open a 2D View window to any size desired (for example, 4000 by 4000 pixels) using Options / Resize to… on its menu bar to specify its height and width in pixels. It will then immediately resize and redisplay this large composite view. This new size will also become the new default size for that Display window. How much larger you can make your View window(s) for reliable operation depends upon the available real memory of your computer.

Update! Subsequent to the duplication of the CDs for V6.50, MicroImages has added the capability to automatically enlarge any 2D View window in your virtual desktop to present a view matching a map scale you select.

How is it used?

You select the size and color depth of your real view within Microsoft Windows according to the available display hardware (single or dual monitors, screen size, desired text and icon size,…). Now you can set the size of your virtual desktop to be larger than this real view in a new tabular X server preferences panel. If you do this, when you start your X-based TNT product a small synoptic view of your workspace and its contents is provided. This new Workspace Overview window is automatically inserted into your real monitor's view.

The Workspace Overview window is the tool used to manage your interface components in a big, virtual desktop or workspace viewed through the porthole of your real view. It is illustrated in the attached color plate entitled Workspace Overview Window. It always stays within the area of your real view to remain accessible. The Overview Window can also be moved to either monitor in a dual monitor system. All your TNT windows and dialogs are represented in thumbnail fashion in this small window in their relative positions and sizes. The outline of your real view of your 1 or multiple monitors is also inserted as a red rectangle in its relative position. Use your left mouse button to move this red outline to any new position in the Overview Window. This will move your

real view to that position in your workspace and instantly show its contents. You can also double click the left button with the mouse on any component to center the real view on it. Scroll bars at the edges of the real view can be used to reposition it in your workspace. You can also scroll the real view by holding down the left mouse button or scroll lock key and moving your mouse to the appropriate edge of the real view.

You move TNT interface components (windows and dialogs) around in your real view with the left button on the mouse. You can now also move them around just as easily using the Workspace Overview window. Simply hold down the shift key, select a thumbnail in the Workspace Overview window, and drag that component to any new position within the workspace. In this fashion you can even move interface components partially off the edge of your workspace to better organize it. If you have a lot of interface components open, it may be difficult to identify them in this small synoptic window from only their thumbnail representations. Positioning the mouse over any thumbnail representation will provide a DataTip to identify it. If you forget how the Workspace Overview window works, use its "?" icon and view the help screens.

All of the components of your virtual desktop are built and stored in true size in memory including the contents of your large View windows. Thus, any movement of any of them in the workspace or movement of your real view to them by any mechanism is nearly instantaneous. The attached color plate entitled Large Workspace and View Windows illustrates the use of the new virtual desktop concept.

What resources are used?

Creating a large X window to define your virtual desktop does not directly use any more of your PC resources. It is how you use this workspace that determines the memory and processor resources it will need. The large X server is merely a graphical construct, in other words, it is merely a means of defining and managing a work area. Dialogs and the other graphically generated TNT interface components require no more memory in a large workspace than in V6.40, where your monitor(s) and Microsoft Windows setting defined your workspace. The size and number of your 2D and 3D views will be the factors that determine the memory and processor speed required for their use in your large workspace.

Memory.

Your workspace provides an instantaneous, real view into any portion of each 2D and 3D display window open in it. To provide this instantaneous repositioning, the view area of each View window is constructed in real memory to the size you select for it. If you are using the recommended 24-bit or 16-bit color mode for Microsoft Windows, your composite view area in each View window will utilize 7 bytes times the number of pixels it contains if any component requires transparency effects or 4 times the number of pixels if nothing is transparent. For example, a display window with a view area of 2000 by 2000 pixels using transparency effects will need 28 Mb of real memory (2000 x 2000 x 7 bytes). If you are still using an 8-bit color mode for Microsoft Windows, then the view area in each of your View windows will use 4 times the number of pixels with or without transparency effects. The number of layers, datatype, color, reprojection, and other such parameters do not change the memory required for your view. The larger collar area (frame, icons, legends, scroll bars, …) of a large View window adds only a proportionally small requirement for additional real memory. An attached color plate entitled Setting Up Your Workspace Size provides conservative guidelines for sizing a workspace for platforms with 64 Mb, 128 Mb, or 256 Mb of real memory installed.

Processing.

The time required to present a composite view in a TNT View window is shown to you at the bottom of the window. It is related to the types of objects used, where they are stored, processor speed, and many other factors. You already have a good grasp of how well your system, new or old, handles your typical TNT displays, fast or slow. You can now create a large composite view in a display window in your virtual workspace. The time to create this larger view will be proportional by area to the time required to create it in a smaller view. For example, you have been displaying a real view of a 500 by 500 pixels section of an 8-bit black and white image in V6.40 in 1 second. As an initial estimate, displaying 2000 by 2000 pixels from this same object in the virtual workspace might take 4 seconds. It might also take less since the 1 second time reported is rounded up to 1 second and there is some fixed time needed to create any view. Once this view has been created, you can move around and view any portion of it as fast as you can manipulate the controls provided.

Impact of virtual memory?

The above example of 28 Mb of real memory for a 2000 by 2000 pixel view will not pose a problem on a system with 128 Mb of real memory unless you are running many other concurrent applications. However, if you make your View window(s) too large, they may not fit or stay in the available real memory. This will cause slow and erratic operation and will make your virtual desktop difficult to use. Keep in mind that your View window(s) may temporarily capture real memory by causing Microsoft Windows to swap out other competing activities to virtual memory. Later these other applications will be allowed by Windows to reclaim that real memory. A View window that is forced to use virtual memory is not likely to crash, but you will have to sit there and wait for it to recover real memory and catch up, or to cancel the TNT process and restart it. Micro-Images has not yet devised a method to protect the memory used by View windows from virtualizing. If memory could be easily protected by an executing application program, all developers would do this and the value of virtual memory would soon disappear.

Caution! Setting your X server too large may cause its operation to go virtual (use virtual memory) and react slowly and erratically.

Microsoft Windows will not report the amount of real memory available. Thus, at present it is not possible in the creation of a View window to determine how much real memory is always going to be available during its subsequent use. As a result, it has not yet been possible to warn you when you set a View window(s) too large relative to your other potential activities. For the time being, as a rule of thumb, do not set up a View window(s) where the sum of all the pixels in the view times 7 exceeds 50% of your real memory if you have 128 Mb of memory or less. If you have more real memory than 128 Mb, you can experiment with using proportionally more than 50% of it for your view pixels since the memory needed for Microsoft Windows and your other applications may not increase as more real memory is added. As you work with the virtual desktop and report your results, future versions of the TNT products will incorporate improved methods to assist you in managing the allocation of memory to it. Adding more real memory is also cheaper. PC100 and PC133 memory used in almost all new Pentium/Windows-

based PCs is currently about US$35 per 128 Mb SIMM, US$80 for a 256 Mb SIMM, and decreasing weekly.

Expand! Adding memory to your TNTmips platform for a virtual workspace will increase your productivity.

Setting Up a Virtual Desktop.

The characteristics of your X server, including its size, can be set by using the tab panels in the new X server preferences dialog. You can open this dialog via the new X server icon, which has been added to your system tray at the right side of the task bar. You can also open this dialog by choosing Preferences from the menu provided by the X server icon in the upper left corner of the title bar in your real view or by choosing Support / Setup / X server from the main menu. The attached color plate entitled Micro-Images X Server Preferences illustrates the setup options for the X server.

Screen Setup.

Proportional Desktops. The Screen panel is used to set up the X server size and, thus, your workspace. If you want your workspace to be some convenient multiple of your real view, use the Workspace Size dropdown menu and select from: Double screen width, Double screen height, or Double height and width. Screen refers here to the size in pixels you have set for your real view of your monitor in Microsoft Windows. Thus, if you choose “Double screen width,” your workspace will behave very similarly with 1 monitor to what was previously achieved by dual monitors. This choice is safe for systems with only 64 Mb of memory. If you already have dual monitors you might want to try the choice “Double screen height,” which will double the height on both monitors. If you no longer wish to use a virtual desktop, select “Full screen size” and your X server size will be set to match your real view area as in V6.40. The attached color plate entitled Setting Up Your Workspace Size illustrates some useful layouts of your virtual workspace for various real memory situations.

User Defined Desktop. When “User defined” is selected in this panel, you simply fill in the pixel height and width required for your workspace.

Other. The Workspace Overview window can be closed just as with any other window. Usually, you will not do this. However, this might be occasionally required such as when you want to take a snapshot of your real view without this window. Selecting the option “Show Overview Window” will make it reappear when the Preferences dialog box is closed. You can also reopen this window with the Overview option on the menu exposed by the X server icon in the menu bar. The color of the background area can also be set on this panel.

Measure Setup.

Accurate uses of the TNT products are based upon using carefully georeferenced objects. The Measure tab panel can be used to calibrate the pixel size on your monitor for direct physical measurements and to display views to a selected screen scale. A display of an entire map or composite image can now be opened to any scale in your workspace based upon its pixel size. If you also wish it to be presented in the real view on your monitor at that scale you will need to calibrate your monitor. If you merely select the size of your monitor, your real view area can be estimated and an approximate

calibration applied. If you wish to accurately calibrate your real view for “to scale” viewing, then you will need to measure the actual height and width of the image display area of your monitor (the maximum pixel height and width) and enter these dimensions in this panel together with their unit of measure.

Other.

An Other tab panel presents some operational parameters. At least 2 additional panels will appear for those using MI/X 3.0 independently from the TNT products. These panels are used to set IP addresses, select and setup a window manager, contact a server, and other activities related to the generic use of X as a remote client.

Restart! You must restart the X server to apply most changes in the Preferences dialog.

*** TrueType.**

The V6.40 X server supported BDF fonts for its interface and TrueType and the older outline fonts were used for layouts. The V6.50 X server supports the direct use of TrueType fonts (TT) in its user interface. Now all aspects of the TNT products can use TT fonts: text editor, layouts, databases, everywhere. You can still use BDF fonts for the interface, but TT fonts are much more widely available in many languages, sizes, and styles. The revised Interface Font List Selection dialog now permits you to select any TT font from all those installed for use with Microsoft Windows applications on your computer.

Multiple language support was adopted early for use with non-English languages on centrally managed UNIX platforms. BDF fonts were developed as part of these activities to support the use of multiple and 2-byte languages. However, accuracy in the representation of a specific language and its aesthetic qualities was not considered critical for these early scientific, professional, and big business computer uses. Applications that did result in the preparation of public access materials in a language (for example in newspaper layout and production) used expensive custom solutions. Under those earlier primitive conditions special abridged computer forms of languages evolved (for example, simplified Chinese, simplified Arabic, Indian encoding ISCII93, …). These computer-adapted language presentations could be read by the general public, but were tolerated as computer-related nuisances.

Widespread worldwide use of personal computers created a demand for much better language management. Today computer users working in any language require that the computer-generated origin of their printed products can not be detected by the use of abridged fonts and styles. This has resulted in the adoption of UNICODE as the character encoding scheme for the Windows, Mac, and LINUX operating systems. Their general integration and support of UNICODE is just nearing completion with the introduction of their second generation operating systems such as Mac OS X and Windows 2000, and soon Windows XP. Earlier versions of operating systems such as Mac OS and Windows gradually eliminated older 1-byte per character encoding schemes from your view, but still retained their use internally (for example, by using ASCII for DOS). Completing their conversion has resulted in better UNICODE support, improved TT fonts for each language, better keyboard entry methods (and eventually better voice and handwriting recognition), and so on. Soon operating systems and application soft-

ware will enter into a new 3rd digital text evolution to support very high resolution flat displays, digital paper, ebooks, and related technological advances.

Improved multiple language support by your operating system has enabled continued improvements in the language support in the X-based TNT products. MicroImages previously introduced TT fonts for use within TNT processes such as map layouts. As more translations of interfaces of the TNT products were prepared, it became clear that the few older BDF fonts for the X server were not complete or suitable for use in some languages or did not exist at all. Those that could be found for a language were missing necessary characters, were not commonly available, provided no choices of styles and form, were not scalable, or were simply incorrect. For example, prior to V6.50 MicroImages had to provide and install a large, 10 Mb Japanese outline font to ensure that one was available. MI/X, the X server, and thus the TNT products, now provide direct support of TrueType fonts. Now our Japanese clients who are using the Japanese version of Windows can simply select one of the TT fonts already installed by Microsoft Windows or any other application.

Now you can acquire, select, and use TT fonts in your TNT products that have been prepared in your nation for other popular computer applications. MicroImages will continue to work with those clients using TNTmips in other languages who wish to assist in improving its application in that language. Our goal is to make the operation of the TNT products and the products you prepare (for example, maps, reports, CD and web atlases, and so on) appear as if the TNT products were actually developed in your nation in your language. A color plate entitled Select TrueType Interface Fonts is attached to illustrate the selection and use of TrueType fonts. To help locate TrueType fonts in your language a color plate entitled Finding TrueType Fonts on the Web is attached.

Font Selection Dialog.

Auto-add Fonts.

The X server now finds the TrueType fonts known to your Windows system and adds them to the list of fonts you can select for your TNT product. When you are selecting fonts for the interface, the TT fonts are listed as having a size of “scaleable” which means they can be used at any size. If you select one and click “Add,” a dialog will pop-up to request the size you wish to use. Once you’ve selected a scalable font and size, you can change its size by editing the size field in the list at the bottom of the font selection dialog.

Automatic Font Selection.

If you switch between languages (localization packages) in the TNT products, each package will load a list of fonts it recommends. For example, the Japanese localization automatically chooses a PCF font, which we supply, that has Kanji characters in it. (PCF, rather than TT, is selected so that the localization is not Windows specific.) If you do not like the defaults, you can change them.

Switching languages is now smoother. In V6.40 when you switched to another language, it reset your font selections to the defaults for that language. You then had to reset them before proceeding. In V6.50 when you switch to another language your font selections for the language you are leaving are saved so that when you switch back, your preferences will be restored.

Multi-Language Windows 2000.

You may be using your language in the multi-language version of Windows 2000 or using the single language version issued in only your language. These versions may have some differences in handling your language. For example, the Japanese-only version Windows IME sends character data to programs differently from the multi-language version used in Japanese. Changes have been made in V6.50 to handle this case and other differences that may happen in other languages.

Clipboard Support.

You can now cut and paste text between TNT processes and other Windows applications using the Windows clipboard. An attached color plate entitled Windows Clipboard Support illustrates this feature for both TNT X-based and TNT Windows-based products. The "?" (help) icon in the Workspace Overview window also provides direct access to Windows help instructions for using this new feature. The same help information can be accessed from the X server icon in the system tray.

Dual Monitors.

Previously MicroImages introduced direct support for multiple monitors into the X server to provide a larger real workspace for your use with the TNT products. More and more of you are now using dual monitors to increase your productivity. MicroImages first began to heavily promote the use of dual monitors with the release of V6.30 of the TNT products one year ago. At that time the Matrox G400 board with dual video outputs cost US$300 with 16 Mb of memory. In April, to reach the video gamers, Matrox also released the G450 for direct use on the PCI bus with dual connectors and 32 Mb of memory at US$110 suggested retail.

The latest Matrox G400 drivers dated 6 April 2001 or later finally provide complete, correct support of dual separate monitors. You can download them from http://www/matrox.com/mga/support/drivers/latest/home.cfm.

The manufacturers of display boards have finally recognized the marketing value of a 2-monitor system for gaming. Gamers want to put the 3D virtual window on 1 screen and their area map and reference dialog on the 2nd screen. As a result, in recent weeks low-cost, powerful dual display boards have appeared on the shelves of computer stores. The current selection of dual display boards range from US$100 to US$150 dollars, provide 2 video connectors, support 32 to 64 Mb of memory, and use powerful graphics chips. One example is the ATI Radeon VE. It seems likely that most future display boards will provide dual monitor support except at the very lowest prices where "component count" sets the bottom end price.

Dual monitors are properly dealt with in the new virtual workspace and simply provide it with twice the area for the real view.

Support of X11R6.

Previous versions of the X server were compatible with the X11R5 standards for X windows. MI/X 3.0 and the V6.50 X server are now compatible with the current X11R6.4

standards for X windows. This increases their reliability for use in the remote access application of the TNT products and on new variants of platforms such as Mac OS and LINUX. It also provides support for more other applications that use MI/X.

Future Plans.

The next revision of MI/X will provide improved support of the virtual desktop concept to automatically display full size maps, composite images, and layouts to scale. Display memory for recently purchased machines is very cheap. Almost all use PC100, PC133, and PC166 SIMMs, even the current Mac models. At this moment a 128 Mb SIMM for a new PC or Mac is about US$40. (It is much higher for older memory required for use in older models.) Since most current PCs ship with 128 Mb and 2 empty memory slots, it is US$80 to increase to 384 Mb, which will easily support the use of a View window containing a whole map or DOQ at its full original scale. For example, display a scan of a 1:24,000 topographic map to scale in calibrated real view and pan and move around over its entire area at will. Display an entire LANDSAT scene, every cell, and move around in it at will. A 4000 by 4000 pixel display window for this purpose would require 7 bytes x 16 mega pixels or 112 Mb of this 384 Mb of real memory. You could then jump to and view or interpret any portion of that scene.

Optimized vector formats, tiled and pyramided images, fast drives, faster networks, and improved TNTmips processes have made it possible to reduce the time to display a typical real view of several layers to a few seconds. Now we can use these software improvements and those to come (wavelet compression, autoscale displays, …) together with continuing hardware improvements (even faster display boards, faster memory, faster bus, multiple gigahertz processors, …) to use maps and images to scale in familiar pieces (in other words, deal with whole 1:24,000, 1:25,000, 1:50,000 maps; complete satellite images, DOQs and DOQQs, and so on). A current 1.5 GHz Pentium 4 based system with 384 Mb of memory and a good display board can easily support this concept and it's only going to get better and faster. These new hardware options and software TNT products modifications are providing you the opportunity to turn your TNTatlas, your TNTview, or your TNTmips into virtual hardcopy products that are not yet available via any other competitive system.

TNTlite® 6.5

Special Distribution by Dealers.

Low cost CDR drives and automatic duplicators are now available. Blank CD media can be purchased for as low as US$.20 (20¢) each. Colorful CD labels can be printed on your color printer. Several MicroImages Dealers are now taking advantage of this to promote their businesses by reissuing TNTlite in their own languages. The graphic for the CD for TNT products is supplied to them and modified to reflect their language and add their logo. The contents of the CD is then reproduced to include TNTlite, their language resource files, local sample tutorial materials, and their other promotional materials. New CDs are then made in-house and distributed as appropriate. Mass runs at duplication plants are planned by some.

Image Analysis in Geology.

The publication of the 3rd edition of Dr. Steve Drury's popular hardcover book entitled Image Interpretation in Geology being published by Blackwell Science has been delayed again until May or June 2001. [One has to sympathize with a printed text book

author after observing this publishing process from up close.] The TNTlite 6.4 will be included on the CD distributed with the book in order to match the exercises and sample data included with it. A promotional brochure and an order form are attached as a color plate entitled Image Interpretation in Geology.

GSB kits.

TNTlite kits with printed black and white copies of every Getting Started Booklet are no longer available for purchase.

Effective with this shipment of V6.50 TNT products, MicroImages discontinues the sale and distribution of the US$75 TNTlite kits containing black and white printed versions of all 58 of the Getting Started Booklets. The continuing increase in the number of booklets and their pages would require further increases in the cost of this kit to cover its assembly and shipping by international express. TNTlite users are now best served by using the color versions of these booklets viewed online from the CD with Adobe Acrobat Reader. The printed color versions of all these booklets in notebook form will continue to be distributed with each new TNT professional product.

TNTatlas 6.5 for X

Saving Sketches.

The sketches and database records you prepare in a free TNTatlas can now be saved as CAD objects in a Project File. If you are using TNTatlas in the field or remote setting, your CAD objects can subsequently be edited, assembled into vector objects, or even exported using TNTedit or TNTmips. Now anyone can use your free TNTatlas to create additional geospatial boundaries and attributes.

Protecting Atlas Contents.

Experienced creators of TNTatlases now use it to distribute proprietary or restricted-use geodata. Up to this point, the Project Files used in the HyperIndex stack provided for the TNTatlas could be read and, thus, exported by TNTmips. This can provide undesired access to the proprietary geodata they contain for other uses. V6.50 provides Project File based restrictions to control the use of Project Files. Coding Project Files in this fashion will confine their use to viewing as normal in the TNTatlas and using them with any unique **SML** tools added to the atlas. But, when the Project Files making up your HyperIndex stack are coded in this fashion, they can not be accessed by any other TNT product. They cannot be read by TNTmips and exported for a use separate from the original features provided by your TNTatlas.

Large Workspace.

You can now set up your atlas to install an X server of a specified size and open a large display window to size. This would be a useful way to start an atlas on your own system whose memory resources are known and will only get larger. This approach should be used with care and with conservative sizes in atlases to be widely used by others on systems of potentially limited memory.

HyperIndex Linker.

It is now possible to link to an external document or URL from a vector object where the document file name or URL is stored in an attribute associated with a vector polygon, line, or point. This permits each element (polygon, line, or point) to link to a different document, executable, table, …, or URL through a single HyperIndex link.

An option is now available, when navigating to a layout, to display it at the scale and position at which it was last viewed. This permits easy setup of the view location and scale simply by zooming in to the desired location before saving the layout. This can even be changed after the HyperIndex link is made without changing the link itself.

Variable scale options from 1/1 up to 1/256 are now available for choosing how a layout is initially displayed after navigating to it.

Inherited New Features.

The following general improvements in all the **TNT** product operations are automatically available in **TNTatlas 6.5**. They can be installed without charge from the **V6.50** CDs or placed on a CD with your HyperIndex and distributed as a free **TNTatlas**. These improvements are detailed below in the major section on New Features for **TNTmips** and include:

- choose from TrueType fonts for X server,
- specify the background color using the .ATL (atlas) startup file,
- read/enter coordinates in the Military Grid Reference System,
- use relative paths to support relocated objects,
- better and more attractive legend for continuous value rasters,
- make groups and layers selection mutually exclusive,
- faster object access/selection when many objects are in a Project File.

Installed Sizes.

Loading **TNTatlas/X 6.5** processes onto your hard drive (without any other products, data sets, illustrations, documentation files, …) requires the following storage space in megabytes.

	for **V6.40**	for **V6.50**
PC using W95, W98, WME, NT, or W2000	26 Mb	26 Mb
PC using LINUX (with Intel) kernel 2.0.36	24 Mb	24 Mb
Mac using Mac OS 8.x or 9.x	49 Mb	41 Mb
SGI workstation via IRIX	27 Mb	28 Mb
Sun workstation via Solaris 2.x	26 Mb	26 Mb
IBM workstation via AIX 4.x (with PPC)	29 Mb	30 Mb
COMPAQ/DEC workstation via Tru64 UNIX (with Alpha)	30 Mb	36 Mb

TNTatlas 6.5 for Windows *(prototype of new TNT product)*

Introduction.

The prototype of a TNTatlas for Windows can be installed from your V6.50 TNT products CD. TNTatlas for Windows is free! No key is required! Those who are using TNT professional products on any other platform, such as Mac OS or LINUX, can install and use this new version of TNTatlas/W on any available computer using Microsoft Windows 95 or later. This new TNTatlas/W will directly use, without modification, an atlas (HyperIndex stack) you have prepared on any platform supported by the TNT products including TNTatlas/X. It also permits you to select and display any single object (raster,

vector, CAD, or layout) in any Project File created on any TNT supported platform. However, you cannot select more than 1 object for such activities (no overlays, on-screen mosaic, …). You will need to use TNTview for these more complex, ad-hoc, multi-layer visualization activities.

TNTatlas for Windows, provided on your V6.50 CD, has many useful applications and features. These are illustrated and summarized on the attached color plate entitled TNTatlas for Windows. However, it does not yet provide all the features in TNTatlas for X. Progress on implementing these remaining features is continuing with high priority. MicroImages expects that these additional features (for example, tabular view and GPS support) will be complete by the time you read this memo. Please use microimages.com to download the latest version.

When you install TNTatlas for Windows you will find that you also have the option of installing **SML** for Windows and **TNTsim** (real time simulation). The **SML** script developed for Windows will require a **TNT** software license key (**TNTmips**, **TNTedit**, **TNTview**, or **TNTsim**) to execute.

Special Features.

There are some new features in **TNTatlas/W** that are not present in **TNTatlas/X**. These are summarized on the attached color plate entitled Features in TNTatlas for Windows. They have been added to this new version because they are standard features in Windows programs and include:

Docking. Toolbars and legend can be docked to the left or right side of the view.

Undocking. Toolbars and legend can be pulled free of the edge (undocked) and become a separate window.

Element Selection. Layer entries in LegendView can be expanded to show element types. The types can then be shown or hidden using the LegendView.

Defaults. The last atlas viewed will be the default selection presented at startup. A list of the last 4 atlases viewed is also provided.

Quick Open. Double clicking on a specific atlas will open up TNTatlas for Windows using that atlas. If TNTatlas for Windows and TNTatlas for X are both installed, double clicking on an atlas will open TNTatlas for X.

Scale Control. The visibility indicator in the LegendView for a layer not showing at the current scale will be dimmed.

GeoToolbox. The delete key will delete an individual point selected by the mouse by pausing close. Page Up / Page Down keys will increase/decrease the number of sides in a regular polygon.

Speed.

The interface and views in TNTatlas for Windows are somewhat faster on a given machine than in the X version. This is because graphical activity, such as constructing a dialog, need not pass through the translation from calls to X functions into Windows actions. TNTatlas/W uses much of the same code base as for TNTatlas/X: the same Geospatial Rendering Engine (GRE), the same Project File routines, and so on. However, it uses new drawing functions that communicate directly with Windows.

Internationalization.

TNTatlas for Windows and all other TNT products released for direct use in Windows are fully internationalized. They can be localized into another language through the use of resource files in the same fashion as all the other TNT products. Microsoft localizes many of its products by releasing a special version of the product some time after the release of the English version. They revise their actual product code, especially their interface layouts to directly use that language. MicroImages has devised a method to automatically conform its internationalized interface components to accommodate each language's variations.

Size.

Loading **TNTatlas/W** 6.5 onto your hard drive (exclusive of any other products, data sets, illustrations, documentation files, and so on) requires 10 Mb.

Published Atlases

The following is a list of some of the new atlases that have been prepared for distribution by MicroImages clients.

Poland.

The WWF-Auen-Institut (World Wide Fund for Nature – Institute for Floodplains Ecology, Germany) published a large, printed 200-page folio color atlas in December 2000. This 12 by 16 inch format atlas is in Czech, Polish, and German (in the same copy) and contains 52 color map plates at a scale of 1:50,000 with transparent overlays. These maps present the landcover and wetlands in the floodplain of an 800 kilometer reach of the Odra river in Poland. The Polish Government is preparing 2 major dams in this area that is also critical habitat for bird migrations through central Europe.

The attached color plate entitled European Freshwater Programme: Oder Floodplain Atlas describes this atlas and illustrates a sample map [reproduced from the WWF web site at www.panda.org/europe/freshwater/regional/oder.html]. The attached 2-sided color plate entitled TNTatlas of Oder Floodplain describes the contents of this atlas in more detail. The following paper by the project leader, Detlef Günther-Diringer summarizes the preparation of this atlas: Der Oder-Auen-Atlas – Eine GIS-basierte ökologische und wasserbauliche Aufnahme und Bewertung von über 800 Flusskilometern. This paper (in German) can be reviewed at http://www.agit.at/papers/searchresult_autor.asp?Autoren=Diringer&Submit=Go%21.

The maps, overlays, and spatial analyses in this atlas were prepared and laid out using the GIS features in TNTmips. They were then transferred to Adobe Illustrator for final embellishment with legends in all 3 languages. During the conduct of this study, both Mac and Windows versions of TNTmips were employed.

WWF has provided MicroImages with a TNTatlas containing all of the map materials in the printed atlas. All these materials, including the Polish base maps, fit on a single CD. At their request, MicroImages has published this atlas online using the Java-based TNTclient at http://testatlas.microimages.com/index.htm test client and the new HTML-based client at http://207.232.79.227/TNTservlet/main.html. The online atlas WWF (German) starts up in German and has used many innovative TNTatlas features, such as scale control on labels and layers. A unique use is how they have provided the means to switch between languages for labels, legends, … at any point in operation of the atlas. Since the atlas was designed with a single level, the navigation button shows a window to let you change your use of the atlas between German, Polish, and Czech.

Istanbul.

HAT, MicroImages' dealer in Turkey, prepared a street atlas of Istanbul in Turkish. This TNTatlas entitled SOKAK SOKAK ISTANBUL was prepared under contract for a flashy monthly Hearst publication named LIFE+. It was then reproduced in about 70,000 copies and distributed as an insert in the May 2000 issue of the magazine. It was so popular that it was distributed again in another subsequent issue of the same magazine. HAT reports they had 1000s of calls regarding this TNTatlas. A color plate is attached entitled Istanbul Street Map to illustrate this TNTatlas.

Turkish Highway Infrastructure.

HAT has also prepared a TNTatlas for the Turkish Transportation Ministry with all the infrastructure data for the major expressway linking Ankara and Istanbul. This atlas contains about 100,000 drawings and other materials ranging down to the scans of engineering drawings of each individual highway sign. While it is 11 gigabytes in size, it is only a test of what might be done for the entire highway system.

Hiking Map.

The National Geographic Society publishes the English, Japanese, Hebrew, Greek, Spanish, and Turkish versions of National Geographic Traveler. HAT prepared a large folded hiking map for GEZI/National Geographic Traveler magazine, which was published in cooperation with the National Geographic Society. This map was prepared in TNTmips and inserted into their October 1999 issue. It provides 2D and 3D colored elevation renditions of the mountainous Kazdagi region of western Turkey. These views provide trail and other reference overlays for hikers visiting Mount Ida and other scenic points in this popular area. The reverse side of the map provides information about the region: mythology and history, flora and fauna, and reference information for hiking. The attached color plate entitled Turkish Hiking Map illustrates portions of the map. Other TNTmips users are preparing trail and dirt bike maps of popular areas.

Mining.

A major mining company has prepared a TNTatlas for each nation in which they have any geodata. These atlases are built up from their geochemical assays (pinmap layers), lease holdings, operation sites, maps and other related overview geodata. These atlases are currently used to provide an overview for internal management and planning further exploration.

Contracts have now been let to commence the work to reduce their approximately 1 million detailed maps and reports (everything they have) to appropriate digital form in Project Files and PDF files. These materials currently represent many decades of field work and an investment of 10s of thousands of man-years. In their current physical form they are primarily warehoused and not used. As a result, it is a daunting task and nearly impossible to assemble all these materials for a specific geographical area.

When their digital reduction is complete they will all be linked into the existing TNTatlas structures to provide the basis for their detailed geospatial analysis of any active area. The simplest kind of application would be to call up everything that is known (the georeferenced reports and maps) for a comprehensive review of some hot spot. This company believes that at least one world class mineral discovery is hiding in this collection and can be discovered in the office by applying various Data Mining techniques to this material.

Arctic.

GeoSurf, MicroImages' dealer in Finland, has prepared several atlases for distribution on CD and to be accessed with TNTserver.

Arctic Sea Route Atlas was prepared for Kvaerner Masa-Yards Technology. The user of this atlas includes the public company Fortum Oyi, the largest energy company in Finland.

Baltic Hot Spot Atlas was published for HELCOM, the Helsinki Commission that provides information on Baltic Sea environmental behavior.

Kurushkul Polder Atlas of Bangladesh was published as part of a United Nations sponsored land protection/reclamation project. It was published in 11 x 17 inch printed color folio format containing 80 pages: 38 color coastal maps were prepared and printed in TNTmips showing cultural and hydrologic features. Each printed coastal map is accompanied by table plates to inventory these individual features.

The printed version of this atlas is entitled Preparation Report for the Proposed Coastal Zone Water Management Programme – Volume IV: Polder Maps. December 2000. It was prepared by Jaakko Poyry Consulting Oy with assistance from DHV Consultants BV, Mott MacDonald Group, Devconsultants, Techno Planners, House of Consultants Ltd., and Desh Upodesh Ltd.

Color infrared images of the area of the study and the boundaries of the 38 polder map units are online as a TNTatlas at www.microimages.com/atlasserver/kurushkul.htm using the Java-based TNTclient. Also try this atlas via the HTML-based TNTclient.

Thailand.

Earth Intelligence Technology (EIT), MicroImages' dealer in Thailand, has prepared a detailed atlas of their nation with many data layers at a scale of 1:250,000. All the materials making up this atlas were prepared in digital form from base maps, databases, images, and other sources using TNTmips. No other atlas of this kind is available for Thailand. You can review this colorful atlas, which fits on a single CD, at www.microimages.com/atlasserver/thailand.htm (note, you will need to choose a language - Thai or English – at the bottom of the page to enter the geographic portion of the atlas.) Also try this atlas via the HTML-based TNTclient.

Nebraska.

New data and new features are continually being added to the Nebraska Statewide online atlas. The ~1300 USGS 1:24,000 topographic maps have been added. They are added as 1300 objects in a single group with no degradation in performance. Note that they use the new mutually exclusive group feature so that they can be selected as an alternative to the orthophoto layer in the atlas (in other words, choose 1 and it shuts off the other).

About 1/10 of the land area of Nebraska is now being released as new orthophotos based on 1999 USGS NAPP stereo photos. The entire state is underway and the southern 1/3 will be finished in 2001. These new orthophotos are being added to the Nebraska Statewide atlas as they become available. The resolution of these new black and white orthophotos is 1 meter. More importantly, however, new DEMs are being prepared and released for the state at a resolution of 10 meters. These will be excellent for use in the TNTsim and in the watershed, viewshed, and other elevation-oriented processes.

Missouri.

MicroImages has just completed the assembly of another sample orthophoto atlas for Missouri. This atlas was assembled to experiment with new procedures added to TNTmips and TNTserver to efficiently handle large collections of objects. This Missouri 1-meter orthophoto atlas can be viewed at microimages.com. It was created from about 5,200 DOQQs prepared by the USDA / NRCS (Natural Resource Conservation Service) for public use.

MicroImages borrowed the 430 CDs from NRCS to use as a test. The CDs contained each DOQQ in lossless GeoTIFF or BSQ format. MicroImages simply set up its older Pentium training machines and used them in parallel to import the DOQQs from the CDs into 234 Project Files on each machine. They were then copied via the network to a RAID drive eventually building up to about 200 Gb (lossless compression only). MicroImages software support staff inserted and then removed the CDs as time allowed.

The orthophoto layer in the Nebraska Statewide atlas is made up of mosaicked 1-by-1 degree units to limit the number of objects. In the Missouri Statewide atlas the 5200 objects in the original 234 Project Files are simply added without modification into 1 group and directly used as 1 layer in a layout.

Note! The objects in the 234 Project Files were imported randomly from the original CDs. But, neither the objects nor Project Files were reorganized into any particular geographic order or structure before use in this new single layout approach.

TNTclient has also been modified so that it will ignore missing layers. Thus, any of these DOQQ objects can be transparently copied in and out of the atlas as long as they have the same name. A new DOQQ can be added to the atlas at any time and the layout will be rebuilt to use it when the TNTserver is restarted.

Maryland's MERLIN.

The Maryland Department of Natural Resources has provided MicroImages with a prototype of a redesigned MERLIN Maryland statewide atlas to replace the current version at www.merlin.net. The test atlas is for Anne Arundel County, Maryland [contains Annapolis, U.S. Naval Academy, part of the Chesapeake Bay, Washington D.C. bedroom communities …]. This new design can be reviewed now at microimages.com. The location and content of this prototype are subject to change as testing and revisions continue.

This is the 3rd redesign of the MERLIN atlas and each one is better than the last as the MDNR staff and MicroImages gain experience in how atlases are built and the TNTatlas, TNTclient, and TNTserver are improved. This latest MERLIN has a completely new design, has several new cultural feature layers, such as a new county roadmap layer, and new imagery such as a complete 5-meter natural color image layer processed to orthoimages from the Indian IRS satellite.

The latest design uses 1 level and scale control to determine which objects show (similar to the Nebraska Statewide atlas). More detailed labels come in progressively by scale as an area is zoomed. Mutually exclusive raster layers and groups introduced in V6.50 are used to limit users to selecting only one base raster (image or map) at a time. Extensive use is made of the individual, small, original objects (not large mosaics) to

provide for ease of assembly and maintenance - just move new georeferenced layers in and out of the group.

Even more exciting are some new layers that will be added very soon. As part of a new experimental program, the United States Census Bureau has prepared a new black and white 1-meter orthophoto layer for Maryland using 1998 USGS NAPP airphotos. From these new orthophotos and other sources they have prepared a 1:12,000 TIGER data set for the entire state. The positional accuracy of this extensive line and database set is 3 to 5 meters, which would actually exceed map accuracy requirements of 1:12,000.

Anne Arundel County, Maryland was the test county for this program and the first county completed in the United States. Thus, this extraordinary new public geodata will appear first in this new MERLIN test atlas at microimages.com for this county as soon as it is in MDNR's possession. Rumor has it that eventually each house may appear in this geodata as a point in the proper position on its street. Rumor also has it that about 90,000 square miles of the United States are being prepared this year in this format. The State of Maryland is 10,000 square miles and is already complete. This means that almost 10 times this amount of 1:12,000 base map data will become available in the public domain this year, probably concentrated in urban areas. Should the area of this data continue to expand further, it will have a profound impact on geospatial analysis.

Periodically questions arise as to how the TNTclient/TNTserver approach compares to those expensive web products of our competitors. MDNR has created and is recreating MERLIN without programmer assistance to date with one systems specialist and several experienced users of the various TNT products involved. Several of the geodata layers in MERLIN have been created over the years by this staff using TNTmips. All of the geodata in MERLIN is in the Project File format and is managed by TNTmips. There is no large computer staff behind MERLIN, simply several dedicated state employees.

TNTsim™ *(new prototype process)*

Why Do It?

Visualization tools used for materials produced as part of your geospatial analysis have special requirements. They must be designed to deal with real earth imagery, terrain surfaces, maps, line data, databases, map projections, and all the other geodata types and characteristics. Your geodata are cartographic in nature and geographically accurate. They must be readily moved between the analysis tools and the visualization tools. There are many excellent stand-alone visualization tools. However, they are not required to provide direct interfaces to a geodata editor, use topological relationships, maintain attributes, classify or otherwise interpret images of all types, or your many other special requirements.

Elevation data is becoming more readily available and once acquired, can be used over and over. It need only be reacquired if it becomes available at a significantly improved spatial resolution. GTOPO30 is a free source of worldwide macro-elevation data. Soon NASA and JPL will be releasing a higher resolution elevation coverage of most of the earth's land surface prepared from the Space Shuttle SRTM mission. Commercial and national sources for even higher resolution elevation models are becoming available for many nations from satellite optical and RADAR imagery processed by specialists. For example, even though Nebraska is a rural state it is now partially financing and releasing new 10 meter elevation rasters of the entire state to improve the accuracy of the

second DOQ mapping of the state. River floodplains and coastal areas with low relief are now being elevation mapped at high resolution using LIDAR.

As more elevation data becomes available, you all want to use it to present your geo-spatial analysis results and materials in a variety of visualization tools ranging from 2D views with many layers, complex printed maps, online via the web, 3D posters, and MPEG movies. All of these are provided by TNTmips, work with a common geodata structure, and can be used together (for example, geolocked). Gradually improving desktop computing and software tools throughout MicroImages' international client base have made it possible to begin adding real-time simulation to these visualization tools starting with V6.50.

What Is It?

TNTsim is the first prototype of a real-time 3D surface simulation process still in the first phase of active development. It operates directly from raster objects in a Project File. It permits you to select a raster object to define a 3D surface structure and to drape it with a 2nd raster object. You can then use your joystick or keyboard to navigate around, that is to fly over, this surface with a television-like frame rate. An attached color plate entitled TNTsim: Real-Time 3D Simulator illustrates a series of frames captured from a simulation.

The elevation raster you select is usually a Digital Elevation Model (DEM) but can represent any raster whose structure you wish to fly over and view from any position in real-time. This elevation raster must be of a signed or unsigned integer data type.

The raster draped over this surface, called an overlay, can be an image or simply the same DEM or raster with a gray or color elevation scale. It is referred to in 3D simulation parlance as a texture layer. It can be a raster object of any data type supported by a TNT Project File.

Constraints!

On Raster Objects.

Acceptable frame rates in moving 3D simulation require a great deal of processor power. In TNTsim most of the individual frame's creation is accomplished by DirectX 8 in the processor of your video card. This is why the gaming industry is driving the features of graphic processors to new advanced levels—they have lots of potential customers demanding better frame rates. However, your main processor must still supply the DEM and overlay image data in the correct form for the current direction of your view. Thus, to fly well in real-time directly from a Project File, there are restrictions placed on your 2 raster objects.

Obviously, both raster objects must have some common ground coverage. However, TNTsim does not yet use these rasters' georeferences. Thus, the 2 raster objects must also have the same extents (same ground area coverage). In V6.50 of TNTsim the overlay raster is automatically stretched to fit the elevation raster so they do not have to have the same cell size. A future version will support using the georeference so that rasters with different extents, but some common ground coverage, can be used.

Permitting the on-the-fly reconciliation of different coordinate systems and projections would adversely affect your frame rate. Thus, you will need to convert the 2 rasters to match in map projection before using them. Null values within the common areas of the rasters are okay, in other words, the rasters can represent irregularly shaped areas.

Nulls in the overlay layer will be mapped to black. Null values in the elevation in the foreground of the view are ignored and have no effect. Null values in the elevation in the background of the view use an interpolated elevation surface.

Windows Only.

TNTsim uses DirectX 8 and, thus, it will only operate on a Windows-based platform that supports it. If you are using the new TNT "combo" key on the USB port of your Mac, you can also use it to install TNTsim on the nearest Windows platform and move your Mac-created Project Files to it.

OpenGL is another common 3D simulation language and is available for the Mac, UNIX, and LINUX in addition to Windows (see www.opengl.org for more details). MicroImages is currently investigating the capabilities that OpenGL provides for a simulation process that can be used on any TNT supported platform within the X server framework. Between them, DirectX and OpenGL are the main driving forces behind the renaissance of PC-based games. They have provided the basis for high speed 3D game strategies and have driven the display boards we are all using to new levels of performance and low prices.

DirectX 8.

When you install a recent Windows operating system, DirectX is automatically installed. However, it may not be DirectX 8, which was first released in November 2000. If your machine is 2 to 3 years old, you probably have DirectX 7. If you do not have version 8 installed, TNTsim will detect this and notify you. If you need to get DirectX 8, go to microsoft.com and download and install it. You may then need to go to the manufacturers of your video card or microsoft.com and get a revised driver for the card that supports DirectX 8. MicroImages has found that most current video board manufacturers who supported DirectX 7 now have new drivers available to support version 8. These new drivers use the display hardware to implement most of the DirectX 8 functions in the graphics chip providing a good response.

If you are having problems running TNTsim, a diagnostic utility is installed with DirectX 8. You can find a shortcut to this utility (DxDiag) at c:\Program Files\DirectX\Setup. Run this utility to see if DirectX 8 is functioning properly.

Note! If you are still having problems with TNTsim after running the diagnostic utility, you can download the Capability Viewer from MicroImages' web site. Run it and it will list each of the DirectX 8 capabilities of your display board. Send this file to MicroImages software support to assist with solving the problem.

TNTsim will produce frame rates of 15 to 30 fps (frames per second) with average video cards and processors of at least 500 MHz. With a new game card or the dual display Matrox G400 and G450 and the latest computers, the frame rate can be as high as 60 fps. If your display card does not support DirectX 8, then Microsoft's software emulation of the missing hardware functions will automatically be used and the frame rate will be unacceptably slow.

As you fly, Direct X converts your elevation raster to a triangular network, more or less a TIN. It then drapes the overlay layer over it. Your board and its Direct X 8 support will control the level of detail you can use in a flyby by setting an upper limit on the number of triangles it can process to represent the surface view at any given time.

TNTsim uses an algorithm to control the level of detail provided as a function of distance from the viewpoint of the frame. This drastically reduces the number of triangles being rendered providing good frame rates while still showing you the most important features of the terrain based on distance from the viewpoint and vertical variance of the terrain.

To fly smoothly, the portion of the larger rasters being used for your current path must be in your main memory. TNTsim currently loads an area of 1024 by 1024 pixels into real memory. This will eventually be changed to take better advantage of your available memory. If you are flying using large rasters, your simulation will periodically hesitate for a moment. This is when it is loading more data from the Project File in the direction you are flying into memory. This halt is something that should be resolved or hidden by improved buffering in future versions.

Basic Operations.

You move your viewing position in the simulation using joystick or keyboard control. For the time being, mouse control has not been provided. You can setup or customize your controls as desired. Use the tool icon to bring up the panels provided by DirectX 8 to configure your joystick or your keyboard. From these panels you can set which button or movement controls zoom-in, zoom-out, turn, roll, throttle, … Your setting will then be saved from session to session. If you do not have a joystick, start experimenting using the keyboard support making logical key assignments such as the arrow keys for up, down, turn left, turn right, ...

Joysticks costing US$10 with 2 axes of freedom and 2 buttons are the minimum that can be used. Microsoft's SideWinder® costs more but provides better ergonomics and smoother operation. Remember that older joysticks require a special game port that is being left off the newer computers. This is because a USB port can also be used and popular joysticks such as the Side Winder and others come with either a game port or USB connector.

You may choose to fly in wireframe mode showing only the triangles whether or not an overlay layer has been selected. The wireframe mode illustrates the level of terrain detail you can expect in the full simulation. If you have added both layers you can use icons to toggle between wireframe only and showing the overlay.

If you are using a platform with more than 1 display board or multiple monitors you can select which video board and monitor to use.

For all display boards, you can choose hardware acceleration, partial hardware acceleration, or software emulation to render the terrain (assuming the board supports it).

You can set the detail distance factor to change the amount of detail displayed and the maximum detail level to adjust the maximum terrain resolution displayed.

You are not prevented from flying through the surface or from viewing it from the bottom. Vertical views are also rendered.

During simulation the status bar shows your display position, heading, velocity, and frame rate. You can optionally superimpose this same information into the frames.

Your ground speed or maximum velocity is initially automatically set to match 1/200 of the extent of the columns in your raster. With this default it will take you 10 seconds to cross your geodata in the initial straight line at a frame rate of 20 fps. This useful default is set to help you start to get the feel of your controls. If not handled this way you

would simply flash across a small raster or creep across a very large one. This setting will be the constant ground speed you will get when you push the key you assign to be the throttle. If a joystick is used, it will be the maximum ground speed you can achieve in the full throttle position. In a future version, this maximum velocity will be adjustable to any rate. It will also need to become independent of the frame rate, so that regardless of how fast the computer renders the terrain, your velocity will remain at the selected value.

A Z-scale factor can be set to increase or decrease, as desired, the minimum to maximum height exaggeration applied for the elevation layer.

Your simulation area has finite boundaries. If it is small, it is easy to get the view reversed 180 degrees and look away from the model. A menu option called “Recenter” will return your view to the starting point.

What Next?

MicroImages has designed this first release to keep the frame rate high (15 to 60 fps). Some of this frame rate could now be traded off as needed to gain more features and flexibility while still achieving acceptable performance. Better frame rates will be automatically achieved as you move into already announced new improvements in graphics chips, a faster data bus and hard drive, faster main processor, and more and faster memory. Some possible next areas of improvement are:

- use the raster objects’ pyramids and tiles in supplying the variation in detail between foreground and background (currently under development);
- use georeferences to control the relative positions of the 2 rasters; and
- support multiple threaded operations or some other approach to dynamically load more data into memory for your projected action (for example, in the projected direction of flight).

Note! Work is continuing on TNTsim with many short and long term goals. Download the latest version from microimages.com to see what has been added or improved.

A priority also seems appropriate for development of a common flight path description for interchange between 2D views, 3D static views, 3D simulations, MPEG movies, GPS paths, … For example, you might use TNTsim to move around and view an area to choose a suitable flight path for an MPEG movie production or to find the optimum view position for the creation of a high resolution 3D poster with many overlays. This flight path would tie together these processes for better control of the visualizations required for geospatial materials.

TNTserver 2.1

Incremental work has continued on the TNTserver. New versions are posted periodically for testing as part of the test atlas area at microimages.com.

Upgrade Pricing Established.

All the new features described herein, except the pending remote layer creation, are included without charge for users of TNTserver 2.x. New features beginning with the remote creation of geodata layers via a TNTclient will require an annual maintenance fee.

This fee will be 20% of the purchase price of your TNTserver including any add-on features, such as additional compute threads.

HTML Printing.

TNTserver can now generate an HTML page for use in printing a color plate representing the atlas page being viewed in any of the TNTclients. The layout of this color plate is governed by an HTML template(s) that the site manager designs for use by the **TNTserver**. While the sample template produces a simple color plate, a site manager can design more complex printed atlas plates with a more advanced template(s). When the end user, via the **TNTclient**, asks for a print, the request is sent to the TNTserver with all the information describing the current view in the **TNTclient** (location, extent, zoom, layers on, …). **TNTserver** then regenerates the atlas components (JPEGs, text, legend elements, …) for that request, just as it would for a new view. However, instead of sending them directly to the TNTclient for viewing, it inserts them into a copy of the HTML template.

The completed HTML description (the filled in template) is automatically sent back to the requestor in a few seconds and **TNTclient** opens it in a second browser window. At this point this HTML layout can be printed just like any other HTML page without special preparations. It can also be saved to the local drive for use and modification in some other program that understands HTML such as Microsoft Word. The attached 2-sided color plate entitled HTML Layouts from TNTserver illustrates the layout of the sample template provided for your use with the sample atlases at microimages.com. The reverse side of this color plate contains an HTML listing of this sample template.

Servlet.

A new component called a servlet must be installed to provide a translator between the **TNTserver** and the new HTML-based **TNTclient**. Servlets requires that a runtime shell be installed to manage and invoke them on behalf of clients. Tomcat is such a container that is free for use with an Apache or Microsoft Internet Information Services (IIS) web server. Tomcat is used to support the operation of the servlet provided by MicroImages. Tomcat and the servlet can be installed on the same platform as the TNTserver or on some other front end platform where Tomcat can also be used for load balancing.

Without the servlet, **TNTserver** communicates directly with the Java-1 based clients. The servlet acts as an intermediary to create the proper communication requested by the specific client (HTML in this first case). It also buffers the server's output to each user via a hard drive, thus freeing up the server and simplifying its protocol.

The servlet provides support for script-based clients. **TNTserver** stores the images and other components in a work directory on a drive specified by the site manager. The servlet then translates these components into HTML and communicates them to the HTML-based client. The servlet could also be expanded to buffer communications with clients based on other code such as the Java-based clients.

Using Prepared Queries.

Custom.

Those who wish to create unique queries can now find out more about the tables, records, and fields attached to the layers available to query. This information is now accessed via the custom query panel. The attached color plate entitled User-Defined

Queries and TNTclient illustrates a simple custom query entered into the Java-based TNTclient.

Predefined.

TNTserver will now respond to predefined selectable **TNT** queries prepared by its site manager. These queries are directed to a specific layer/attribute set in the HyperIndex stack. Accompanying the query can be the number of levels to navigate down in the stack to find the layer/attributes and the action to be taken, such as a zoom factor. For example, the **TNTclient** user fills in the blanks in the interface (name, address, zip, …). The query is sent with these values to **TNTserver** for evaluation. Accompanying the query is the preprogrammed request to navigate to the level of interest and the zoom level required. **TNTserver** moves into the atlas the 2 levels specified to locate the layer/attributes of interest. It then evaluates the query on those attributes to locate and select the element(s). The requested composite view is zoomed to include the extent of these elements and sent back to the client. The attached 2-sided color plate entitled Predefined Queries and TNTclient illustrates the use of several aspects of the queries built into the Java-based TNTclient.

Fuzzy Queries.

After **V6.40** was shipped, the query procedure used in the **TNT** products was modified to return a fuzzy result between 0 and 1. Before this modification, your queries were evaluated to determine how well they matched in each test and yielding a value of 0 or 1. Features using this fuzzy or probabilistic query result will gradually appear in future **TNT** products. They are already being tested in the **TNTserver**. Each test of a query can be used or rejected by the **TNTserver** or in the **TNTclient** based on the probability of a match.

An example will serve to illustrate how this probability of match will work. Many web sites that allow you to search and view maps will evaluate a search for 901 Main and return multiple results in some fashion. Even the simplest of these results might include 901 Main, 901 N. Main, and 901 E. Main. At a good site, you will be given a message to narrow your search or a choice of these results before the action of retrieving a map. Each site handles this ambiguity in a different manner. But, the most probable result is that the entry of 901 Main is not requesting the other 2 locations. A query to the **TNTserver** will find the most probable result for this address and the other 2 locations with lower probabilities. The appropriate action can then be taken. In this example, the client will get all three choices and the highest probability choice will be highlighted and its view automatically shown. The other 2 choices are also presented in the list for selection and their views directly retrieved.

Miscellaneous.

Mutually Exclusive Layers and Groups.

TNTatlases can use layers and groups that are set up to be mutually exclusive of other layers and groups. If a group has mutually exclusive layers then turning one on will automatically turn off all others. For example, selecting 1 of 4 mutually exclusive rasters in a group (4 dates of available image coverage) will turn off all 3 of the other layers in the group. **TNTserver** has been modified to adhere to this option in atlases and to communicate appropriate layer controls to the **TNTclients**.

More Scale Control.

TNTclients can now specify a minimal view distance (the width of the view on the ground). This value for the minimum view distance tells the **TNTserver** not to zoom the view in any further than this setting. This constraint is used for query results since the **TNTserver** will attempt to zoom up to the extents of the line or lines selected. This can be a problem since many address lines are only a block long. Setting this value will ensure that the area covered by the view is realistic and not zoomed in too far.

Query Data on Demand.

The Java-based TNTclient currently has a query panel that can retrieve a list of tables and fields from which to build the query then send the query to **TNTserver** to evaluate and produce the required view. This table and field information is now sent separately to the TNTclient and only when requested to speed up other uses of the atlas until a query is selected.

Remote Polygon Creation.

The idea of extending **TNTserver** to support the remote creation of points, lines, and polygons over the views in a **TNTclient** was outlined in this section in the MicroImages MEMO that accompanying **V6.40**. It is not yet available. The modifications to the **TNTserver** to accommodate this new feature are underway. The modifications to a test version of the HTML-based **TNTclient** will be started soon to test this next feature.

Java-based TNTclient.

Predefined Queries.

This type of query, where the end user simply fills in the blanks, was introduced first into the Java-based client. These queries can be tested at microimages.com in the sample Anne Arundel, Maryland atlas where a search can be made by address and will return the selected theme. The attached color plate entitled Predefined Queries and TNTclient illustrates the use of several features of queries built into the Java-based TNTclient.

In the Nebraska Statewide atlas, the new Show Me in Nebraska Panel gives you the choice to search by address, city name, township and range, or by latitude and longitude. You can select the type of view you want returned from the atlas. If you search by address, you will be using a fuzzy query as described above, which may return a list of choices for your selection when it fetches the most probable view you have requested. As part of the query you can specify the zoom of the image being fetched. The results of your search, such as the number of addresses found, are displayed at the bottom of the panel.

Improved Control.

The Java libraries, which must be downloaded for use with this TNTclient, have been split up to match the selected components in the client. When the site's manager selects the panels to use in the client, they can also select and use only the corresponding Java libraries, omitting those for any features not required. The site manager can also decide which actions and/or toolbars are to be presented for each tabbed panel in the client. Previously the entire client was downloaded and simply suppressed from the TNTclient interface by settings in the HTML used in the site's general server.

HTML-based TNTclient.

Why?

Those of you following the computer literature know that Sun and Microsoft continue to do battle over the Java concept and language: Sun by creating and promoting it, Microsoft by trying to suppress it and insert their own approach. The overall result of this is to further fragment Java and relegate it to merely another web-oriented programming language. Java-1 has idiosyncrasies between platform types and is limited in scope. Java-1 web downloads are also prevented from passing through many firewalls as, since they are executed, they could be a virus.

Java-2 programs can be more sophisticated and provide more capabilities. Unfortunately this environment is not provided with Microsoft Explorer and requires a big download before you can view a Java-2 based site. Site managers are even more concerned about permitting the download of these plugins.

Advantages.

At the onset of the TNTserver product release, MicroImages staff assumed that the argument over Java would eventually be resolved. This looks less likely now as Microsoft releases its parallel NET products. As MicroImages has progressed, the software engineering staff has learned more about the use of HTML and its advantages over a Java-1 based approach. It was also assumed that the use of Java-1 would provide a public client that could be distributed as source and would be modified and improved by our clients. Over the past 2 years, MicroImages has learned that you do not wish to get involved in customizing Java code to support a special use. On the other hand, anyone who wants to set up a TNTserver needs to set up a site or have it done for them by someone. That party will have to be experienced in the use of HTML and probably JavaScript (not to be confused with Java programs). Thus, you or they will be able to modify a client created in HTML with recyclable JavaScript components.

Over the past several months MicroImages has concentrated on creating an HTML-based client with the same features and similar form to the Java-1 based client. The attached color plate entitled HTML Version of TNTclient and HTML Client Work Area Panels (back side) illustrates some of the features of this new **TNTclient**. The attached 2-sided color plate entitled Predefined Queries with HTML client illustrates the use and design of 2 simple queries just added to the HTML-based client. On the reverse, it shows the simple HTML form that is used to collect the input from the end user and the simple TNT query, that is added at the TNTserver to evaluate what the end user enters into the form.

Now you have the choice of which one to use: Java-based or HTML-based. By the time you read this MEMO MicroImages will have reorganized the Online Atlas portion of microimages.com so that by default it will use the HTML-based client for the following reasons.

Faster. The HTML-based client is smaller and, thus, faster to download and startup than a Java-based client. Private users of a Java-based TNTclient can be expected to have the pieces (for example Java-2) or all of it (a TNTbrowser) needed to operate it already installed. They are going to come back again and again, so setting up for operation is an acceptable delay. Public end-users of an atlas outside the United States and Europe are almost all connecting via a phone modem. These public users will not tolerate the Java-based TNTclient's long download / start up times over their slow connection.

The HTML client is downloaded as compressed JAR (Java archive) files. These JAR files are automatically uncompressed and the interface and functions are built by every popular browser. V2.0 of the HTML client as downloaded in compressed form is ~67 Kb for initial operation and grows to 95 Kb if all the optional control panels are subsequently selected, downloaded, and used. Each of these optional control panels is about 10 Kb. The V2.0 Java-based client as downloaded in compressed form is 413 Kb. As a result, the HTML-based client is up and running in 1/5 the time of the Java-based client.

Uses Standard Ports. When anyone uses an HTML client they are only required to have port 80 open. This is the standard port that must be open for any site to operate using HTML. The Java-1 client required other ports to be open. Military and some commercial sites will not open the required ports, and those that do often close them by accident.

Works in More Browsers. HTML is the basis for the public Internet. Unfortunately, even in this basic HTML approach, features are used that do not exist in earlier versions of the browsers. However, a client built upon HTML has more probability of working correctly on older browsers and in future versions.

Standard Browsers. Only HTML (actually Dynamic HTML) and JavaScript are required to operate this new client. The components that use these protocols are automatically installed with your browser on the Windows, Mac, and LINUX platforms. If any of these browser protocols are damaged, disabled, or deleted you will not be able to visit very many web sites with that browser.

Easier to Extend. The features in the HTML-client are similar to those in the Java-1 based client. However, the HTML client is easier to modify or use as the basis for other clients by recycling its components.

Download on Demand. It has proven easier to download the HTML-based client in pieces. Java-1 does not support this kind of piecemeal downloading in the background or on demand. This has much better support in the contested Java-2 environment.

Firewalls. Some firewalls lower resistance to attack if special ports are opened to omit access other than by HTML. HTML can pass though the firewall of any location providing its users with access to the net.

Viruses. Viruses are less likely to circulate with HTML than if hidden within Java-based executable programs.

Internationalization. Alas, Java-1 does not provide complete support of some 2-byte languages. Those of you using those languages in your browser already know this and may have already downloaded Java-2 or some other patch that can be used as a corrective measure.

Better Printing. To print a screen from a Java-based application requires that more than the standard, default permissions be granted to your browser. It requires that you permit the Java client to send something outside the captive environment it operates in (the so called sandbox). Letting a web site do some things on your computer, such as write a file, is a potential trap door for viruses. As a result, printing from a TNTclient is now supplied on request to the TNTserver. It sends back the current view as HTML, which the browser then interprets, shows, and prints directly. The HTML-based client easily interacts with this and this same feature is availalbe in the Java-based client.

Improved Server Communications. The servlet built for use with the HTML client operates with TNTserver to improve its communications. It permits the TNTserver to write

responses to its hard drive. The server finds it later when required by the client. The Java-based clients still communicate directly with the TNTserver where more I/O thrashing can occur when many users are active at once.

TNTview® 6.5

Inherited New Features.

The following general improvements in all **TNT** product operations were automatically added to **TNTview 6.5**. These improvements are detailed below in the major section on New Features for **TNTmips** and include:

- use of a large virtual desktop through the new X server,
- create large, scaled display windows,
- choose from TrueType fonts for X server,
- save sketches made in GeoToolbox as CAD layers,
- conduct Multi-Criteria Decision Analysis using the wizard in GeoFormula,
- write **SML** scripts to create MPEG simulations,
- extrude polygons in 3D view,
- raise symbols on reference stalks in 3D view,
- use a new process to dissect the formats of unknown geodata files,
- read/enter coordinates in the Military Grid Reference System,
- better and more attractive legend for continuous value raster,
- limit objects to use only in TNTview (therefore no export via TNTmips),
- make selection of groups and layers mutually exclusive,
- import several new formats such as ASTER, and
- faster object access/selection if many source objects are in the Project File.

Upgrading.

If you did not order **V6.50** of **TNTview** in advance and wish to do so now, please contact MicroImages by FAX, phone, or email to arrange to purchase this version. When you have completed your purchase, you will be provided an authorization code. Entering this authorization code while running the installation process allows you to complete the installation of **TNTview 6.5**.

The prices for upgrades from earlier versions of **TNTview** are outlined below. Please remember that new features have been added to **TNTview** with each new release. Thus, the older your current version of **TNTview** relative to **V6.50,** the higher your upgrade cost will be.

Within the NAFTA point-of-use area (Canada, U.S., and Mexico) and with shipping by UPS ground. +50/each means US$50 for each additional upgrade increment.

TNTview Product	Price to upgrade from **TNTview**:					**V5.90**
	V6.40	**V6.30**	**V6.20**	**V6.10**	**V6.00**	and earlier
Windows/Mac/LINUX	$175	275	400	500	555	+50/each
for floating license	$210	330	480	600	667	+50/each
DEC/Alpha via NT	$250	350	500	600	700	+50/each
UNIX single user	$300	475	600	675	725	+50/each
for floating license	$360	570	720	810	870	+50/each

For a point-of-use in all other nations with shipping by air express. +50/each means US$50 for each additional upgrade increment.

TNTview Product	Price to upgrade from **TNTview**:	**V5.90**

	V6.40	V6.30	V6.20	V6.10	V6.00	and earlier
Windows/Mac/LINUX	$240	365	465	545	605	+50/each
for floating license	$288	438	558	654	726	+50/each
DEC/Alpha via NT	$300	450	550	650	750	+50/each
UNIX single user	$350	550	700	800	850	+50/each
for floating license	$420	660	840	960	1020	+50/each

Installed Sizes.

Loading **TNTview 6.5** processes onto your hard drive (exclusive of any other products, data sets, illustrations, documentation files, …) requires the following storage space in megabytes.

	for **V6.40**	for **V6.50**
PC using W95, W98, WME, NT, or W2000	29 Mb	35 Mb
PC using LINUX (with Intel) kernel 2.0.36 - 2.4	27 Mb	28 Mb
Mac using Mac OS 8.x or 9.x	51 Mb	43 Mb
SGI workstation via IRIX	32 Mb	34 Mb
Sun workstation via Solaris 2.x	29 Mb	30 Mb
IBM workstation via AIX 4.x (with PPC)	34 Mb	35 Mb
COMPAQ/DEC workstation via Tru64 UNIX (with Alpha)	35 Mb	36 Mb

TNTedit™ 6.5

Several significant new features were added to the Spatial Data Editor in **TNTmips** and, thus, are also available in the stand alone TNTedit product. They are briefly introduced here and more detailed information on each topic can be found below in the section under **TNTmips** entitled Spatial Data Editor and the attached color plates.

Restarting a Session.

By popular request, edit sessions can now be restarted by saving and subsequently restoring the display group you have set up in the Spatial Data Editor. More details on this new capability in TNTedit can be found below in the TNTmips section entitled Restore Edit Session.

Large Workspace.

TNTedit operators will benefit significantly by working in the new large workspace to instantly pan to and edit any part of the layer selected. Set up a large View window in the workspace so you can load the entire extent of the layer to be edited at a workable scale. Setting up and managing a large workspace is described in detail above in the section on the X server. How to enlarge a display window to give you instant access to any part of your layer is covered in detail in the Geospatial Display section below.

Optimizing.

Vector layers are automatically saved by default into the optimized vector object structure. This does not affect any use of the object except to speed up the display and other actions performed on subsections of the object.

Suppress Standard Tables.

You can now automatically supress the computation of the standard tables every time you save a vector object. Computing these properties during an edit session is usually not needed and may significantly slow a save operation.

Snap to Other Layers.

Often the feature you wish to connect your current drawing element to is in another layer. Now, at any time you are creating or editing an element, you can choose another layer and snap to the nearest element in that layer. The type of snap mode you wish to use can be selected just as for elements closed by snapping to elements in the same layer.

Nodes to Points.

Nodes can now take on the characteristics and uses of point elements. An example of this would be to treat the nodes at the intersection of lines as point elements and add attributes to them. As long as all the lines remain, these nodes are treated and used as nodes and points. However, if the lines that are attached to the nodes are deleted, the node will be converted to a point element to preserve the attribute information.

Labeling Along Curves.

Labels can be manually placed along, or orthogonal to, curved lines such as streams. The lettering can be above, below, or on the lines. It can follow the inflections in the lines exactly, or it can follow a spline curve fit to the segment of the line matching the extent of the label.

Explode Elements.

CAD elements can be encountered in some Shapefiles that are made up of multi-point, -line, or -polygons. These are treated as substructures in that file for some special convenience. These elements can now be exploded into their component parts for more detailed editing and use.

Use Multi-elements.

Multi-point, multi-line, and multi-polygon elements can now be added and manipulated as entities in CAD objects.

Inspect Files.

A new Inspect Files process is provided to assist you in determining the format of unknown geodata files. It is especially useful for rasters and file headers.

Upgrading.

If you did not order **V6.50** of **TNTedit** in advance, and wish to do so now, please contact MicroImages by FAX, phone, or email to arrange to purchase this version. When you have completed your purchase, you will be provided an authorization code. Entering this authorization code while running the installation process allows you to complete the installation of **TNTedit 6.5**.

The prices for upgrades from earlier versions of **TNTedit** are outlined below. Please remember that new features have been added to **TNTedit** with each new release. Thus, the older your current version of **TNTedit** relative to **V6.50,** the higher your upgrade cost will be.

Within the NAFTA point-of-use area (Canada, U.S., and Mexico) and with shipping by UPS ground. (+$50/each means US$50 for each additional upgrade increment.)

TNTedit Product	**Price to upgrade from TNTedit:**					**V5.90**
	V6.40	**V6.30**	**V6.20**	**V6.10**	**V6.00**	and earlier

Windows/Mac/LINUX	$350	550	700	800	875	+50/each
for floating license	$420	660	840	960	1050	+50/each
DEC/Alpha using NT	$500	750	950	1100	1200	+50/each
UNIX single user	$650	1000	1350	1600	1750	+50/each
for floating license	$780	1200	1620	1920	2100	+50/each

For a point-of-use in all other nations with shipping by air express. (+$50/each means US$50 for each additional upgrade increment.)

TNTedit Product	**Price to upgrade from TNTedit:**					**V5.90**
	V6.40	**V6.30**	**V6.20**	**V6.10**	**V6.00**	and earlier
Windows/Mac/LINUX	$500	750	950	1100	1200	+50/each
for floating license	$600	900	1140	1320	1440	+50/each
DEC/Alpha using NT	$600	900	1150	1400	1500	+50/each
UNIX single user	$750	1200	1550	1850	2000	+50/each
for floating license	$900	1440	1860	2220	2400	+50/each

Installed Sizes.

Loading **TNTedit 6.5** processes onto your hard drive (exclusive of any other products, data sets, illustrations, documentation files, and so on) requires the following storage space in megabytes.

	for V6.40	for V6.50
PC using W95, W98, WME, NT, or W2000	58 Mb	53 Mb
PC using LINUX (with Intel) kernel 2.0.36 to 2.4	58 Mb	50 Mb
Mac using Mac OS 8.x or 9.x	63 Mb	57 Mb
SGI workstation via IRIX	75 Mb	63 Mb
Sun workstation via Solaris 2.x	63 Mb	54 Mb
IBM workstation via AIX 4.x (with PPC)	80 Mb	68 Mb
COMPAQDEC workstation via Tru64 UNIX (with Alpha)	87 Mb	73 Mb

Free Training

The free training sessions have been of considerable value to those who have attended. The MicroImages' staff has enjoyed meeting a variety of clients during these sessions. Three additional free training sessions are being offered in 2001: 14-18 May, 16-20 July, and 17-21 September. Please note you should register early as current demand for places in these training sessions is rising, and there is an upper limit on the number of people in the facilities used and the computer equipment available. A color flier is enclosed to describe this free training and includes a registration form. You can find the contents of this flier and the registration form at http://www.microimages.com/ announce/freetrain.htm.

Note! MicroImages has scheduled no further free training sessions beyond those in May, July, and September. It is possible that training will no longer be free after the September session.

QuickGuides

11 new 1-page QuickGuides are enclosed with **V6.50,** bringing to 27 the number provided in printed form with each new **TNTmips** product. If you have suggestions for

QuickGuides that might help you or others remember special features, please let us know.

- Virtual Desktop
- **SML** Scripts
- Relief Shading
- Cut and Paste
- Mutually Exclusive Groups
- Tabular Views in Layouts
- Copying Symbols
- Computed Attributes
- Color Relief Shading
- Connect Points
- Mutually Exclusive Layers

All 27 QuickGuides can be downloaded in Adobe Acrobat Reader PDF form from http://www.microimages.com/didyouknow/.

Getting Started Booklets

There are now 58 Getting Started Booklets. These tutorial and reference booklets provide 1432 pages and over 3300 color illustrations. They are up-to-date with the features in **V6.50** of the **TNT** products. Remember that each new **TNTmips** now comes with 2 thick notebooks containing a color, printed copy of every booklet. Those of you receiving your **V6.50** upgrade on CD can view and refer to any booklet using Adobe Acrobat Reader. If you install all these booklets as part of any **TNTmips** product, you can directly access these booklets via Help / Getting Started.

New Booklets Available.

Four new GSBs are being released for the first time with **TNT V6.50** and are introduced in the attached color plate entitled New Getting Started Tutorials. They are:

- Getting Started Printing (20 pages),
- Introduction to TNTserver and Clients (24 pages),
- Network License Setup and Management Guide (32 pages), and
- Introduction to Interpreting Digital RADAR Images (20 pages).

Changes and expansion were also made in several other booklets.

GSB Kits.

Effective with this shipment of **V6.50 TNT** products MicroImages will discontinue the sale and distribution of **TNTlite** kits containing black and white printed versions of the Getting Started Booklets. The color versions of these booklets are now distributed with each new **TNT** professional product in notebook form. **TNTlite** users are best served by using the color versions viewed online from the CD with Adobe Acrobat Reader.

MicroImages will no longer sell TNTlite kits accompanied by the printed Getting Started Booklets.

Online Reference Manual

V6.50 of the Reference Manual for the **TNT** products has single-spaced pages distributed as follows.

- Basic System Operations 202 pages
- Edit 283 pages
- Support 100 pages
- Glossary 94 pages
- Display 719 pages
- Process 1075 pages
- Appendices 22 pages

2495 total

The following supplemental documentation was prepared after the masters were duplicated for **V6.50** and is enclosed in printed form:

- 3D Panel 8 pages
- Edit Symbols / Edit Line Patterns / Edit Bitmap Patterns 1 page
- Extract and Trim DRGs 2 pages
- Group Settings Window 4 pages

New TNT Features

*Paragraphs or main sections preceded by the asterisk "*****" symbol introduce significant new processes or features in existing processes released for the first time in **TNTmips 6.5**.

System Level Changes.

Installation.

When installing over a previous version, an option is now provided to retain the existing defaults in the .INI files or replace them. This allows you to retain your settings if your practice is to upgrade by overwriting the previous version.

Object Selection.

The "Show Overview" option has been changed from a toggle to a button and an "auto-open" toggle has been added to the Overview window. It can be used to easily open and close this window without changing the preferred behavior.

* X Server.

There are substantial changes in the X server for Windows computers. You may now create and use a "Virtual X desktop" much larger than your real view. All the Windows-based TNT products are enhanced by this new large workspace approach. Please see the detailed description of these changes in the major section above entitled X server.

Project File.

Buffering.

Setting of the size of the Project File cache is now available:

"Support / Setup / Preferences..." in **TNTmips**®,
"Options... (Icon) / General Options..." in **TNTedit**™, and
"Setup...(Icon) / General Options..." in **TNTview**®.

This value can be set in the "Project File" panel. Increasing this setting from its default can improve performance of the **TNT** processes if you are running on a machine with more than 64 Mb of memory.

Creating Objects Faster.

All TNT processes now use new, low level libraries to create and manage the objects in Project Files. The most immediate benefit of this is that it is much faster to create or locate a large number of objects or subobjects in a Project File. This can be 1000s of times faster when 100s and 1000s of objects are involved.

Many of you are already involved in projects with 100s, even 1000s, of maps or images that can be organized into a few convenient Project Files (for example, 1 per county). No longer does increasing the number of objects in a Project File slow down the access to an object in it while you wait for them all to be opened. The TNT products have al-

ways been advanced in handling the big objects and now can better manage many objects in a single Project File.

Some areas of your activity will obviously benefit from faster object access. Multispectral images are increasing in the number of spectral bands available. Topographic maps or digital orthophoto quads (DOQs) can be organized into Project Files by county or other convenient unit. Collections of digital photos can be organized by the area they cover.

Another important benefit is in managing style objects that are rapidly growing in number and size with improvements in legends, pin mapping, and cartographic capabilities. For example, the U.S. military symbol library, which can now be imported from the Computer Graphics Metafile (CGM) format, yields more than 6000 styles in a single style object. Each style describes a shape and its characteristics. The creation and location of these kinds of styles and patterns in style objects is much faster, in some cases 1000s of times faster.

These new libraries have also been added to support the future introduction of multithreaded processing into the TNT products, the implementation of a Project File server (in other words, simultaneous multiple users of a single object over a network), and other advanced features. For example, several different users or processes could use a single object if only the blocks in the object, not the entire object, were locked or marked and unlocked as required.

Relative Paths.

Relative paths are now supported for linked RVC objects, external database tables, external rasters, and external text files. This provides faster searching for linked external files when they are moved, but the directory structure is maintained, for example, if it is copied to a CD or hard drive.

Controlling Access.

You can now lock a Project File so that only the **TNT** products you designate can gain access to the objects in that file. For example, you could designate that only **TNTview** could use the Project File created in **TNTmips** or vice versa. A typical application is to produce restricted access Project Files for use in a free **TNTatlas**. Now these Project Files can be locked for use only in **TNTatlas**. This allows them to be viewed and used in the atlas but not in any other **TNT** product. They are “read-locked” to **TNTatlas**. This would prevent anyone using a **TNTmips** to extract and export any of the digital layers from the **TNTatlas**.

Maintenance.

Project File maintenance now provides raster trend parameters and coefficients in the Object Information window. These include trend order, scale, offset, and polynomial coefficients.

Older Materials in LegendView.

Sample images are now provided in LegendView for objects in older Project Files, even those on CD-ROM media.

Geospatial Display.

* Big Display Windows.

On V6.50 CDs.

The section above on the X server describes in detail how to set up and use a workspace that is much larger than the real view on your monitor. To take advantage of a large workspace (your virtual desktop) you will often want to open large 2D display windows. **V6.50** provides a means to do this directly from the View window using Options / Resize to…, which opens an Auto Resize To window. This window shows the size in pixels of your X workspace and the height and width of the associated display window. Entering new height/width values for your View window and closing the Auto Resize To window will resize the associated display window to that size and redisplay its contents. If you enter a height or width that is larger than can be included in the workspace, these values will reset to the maximum that will fit.

Modifications since **V6.50** CDs.

MicroImages has continued adding new ways to use your large workspace while shipping the **V6.50** CDs. A new display program is already available to provide easier ways to resize your View windows. It provides a new Auto Resize To window with additional options to change the associated display window.

Scale to Maximum Extent. Enter a scale and choose the check box Entire Extent at Scale and the display window will resize to fit the extent of all the layers at the scale shown. The largest scale you can enter (smallest base number for the representative fraction) is the scale of your view if the View window fills your entire large workspace. If you enter a smaller number than this to obtain a larger display window, it will be rejected and the smallest allowed number will be shown. If you enter a smaller scale (a larger number) that can be accommodated, it will be accepted and when you enter OK the display window will resize and redisplay your composite view at that scale, and it will contain all the extents of all layers in your composite view.

Scale to Active Layer. Enter a scale and choose the check box Active Layer At Scale and the display window will resize to fit the extent of the active layer at the scale shown. The largest scale you can enter (smallest base number for the representative fraction) is the scale of your view if the View window fills your entire large workspace. If you enter a smaller number than this to obtain a larger display window, it will be rejected and the smallest allowed number will be shown. If you enter a smaller scale (a larger number) that can be accommodated, it will be accepted and when you click OK the display window will resize and redisplay your composite view at that scale, and it will contain all the extent of the active layer in the composite view.

Scale to Active Layer's Pixel Size. The Active Layer At option provides some convenient choices for resizing your display screen relative to the pixel size of the active layer when it's a raster. Typical choices are 1X, 2X, 1/2X, 1/3X, and 1/4X. Choosing 1X will zoom the active raster layer 1 to 1 (1 cell per display pixel). Choosing 2X will zoom the display so that each cell in the active raster layer becomes 2 by 2 display pixels. Choosing 1/4X dezooms the display window to a 4 by 4 sampling of the cells in the raster layer. These number options can only be selected if the active layer is a raster and will fit your workspace at the numbers presented.

Special Upgrade. These new display procedures are illustrated on the attached color plate entitled Automatically Resize View Window to Scale. You can download the post **V6.50** revised display program containing these new resizing options from http://www.microimages.com/freestuf/tntpatch/. This special version of the display program will not be altered further to avoid introducing errors as MicroImages proceeds to make more modifications to the process.

Note! The special post V6.50 display program for resizing a display window to scale has been frozen to avoid possible errors being introduced by other changes.

Raster Legends.

A new "Color Scale Ranges" legend type is now available for use with imagery displayed with a continuous color palette. You can use this new legend type in LegendView or in your layouts. You choose the number of legend entries desired. The legend created divides the raster's data range into that number of steps. A column of an equal number of legend boxes is created and labeled with the data range it represents. Each of these legend boxes is filled with the color in the raster's color palette representing the midpoint of the data range for that legend box. An attached color plate entitled Color Scale Ranges illustrates this new legend type.

Full Resolution.

Any raster image layer may now be zoomed "one-to-one" (showing every pixel) by right-clicking on the layer's icon in the LegendView and selecting the option "Zoom Raster One to One" from the menu.

Mutual Exclusivity.

For Layers.

It is now possible to specify that the layers in a group are mutually exclusive. This automatically prevents more than one layer in that group from being shown at the same time. When you select or check on one layer in the LegendView, the other layers will be unselected. This feature is useful for controlling multiple, coincident images from different sources or dates where showing one image hides all images below it. It is also useful for the same function in assisting the user of a **TNTatlas** in selecting one of several images or maps available for the area.

For Groups.

It is also possible for a group to be mutually exclusive with other specified groups. When 1 group in a set of groups is selected, all other groups in that set are automatically unselected. Up to 8 sets of mutually exclusive groups may be defined. Groups in one of these sets are mutually exclusive with each other but not with groups in other sets.

Vertical Scaling.

If the Z scale of the 3D vector is set, it will be used for vertical scaling in 3D views. This permits vector data to be used with the Z scale in feet, meters, or other units.

Clipping.

An option is now available to clip a group to the "auto-matched" layer. In some cases this allows easier control of clipping extents as it will account for object orientation relative to a projection.

Using MGRS Coordinates.

Military Grid Reference System (MGRS) coordinates can now be selected for reporting in the box in the lower center of the scale position line in a View window. You can also

directly enter an MGRS coordinate in this box (just like other coordinates) that will pan the view to center on that coordinate. Switch this coordinate position report to MGRS mode just like you switch to any other coordinate report mode: Options / Position Report / Projection… and use System to switch your reporting boxes to the MGRS or any other coordinate system.

Pinmap Layers.

The position of a symbol in a pinmap can now be offset from the point's coordinates. Use 'SymbolOffsetX' and 'SymbolOffsetY' in the pinmap script to specify the offset.

HyperIndex Linker.

It is now possible to link to an external document or URL from a vector object where the document file name or URL is stored as an attribute associated with a vector polygon, line, or point. This permits each element (polygon, line, or point) to link to a different document, executable, table, …, or URL through a single HyperIndex link. A color plate entitled Dynamic HyperIndex Links is attached to illustrate this new feature.

An option is now available when navigating to a layout to display it at the scale and position at which it was last viewed. This permits easy setup of the view location and scale simply by zooming in to the desired location before saving the layout. This can even be changed after the HyperIndex link is made without changing the link itself.

Variable scale options from 1/1 up to 1/256 are now available for choosing how a layout is initially displayed after navigating to it.

3D Views.

Modifications in the "Vector Layer Controls" dialog were made to add a new "3D" tabbed panel used for designing extruded polygons and stalked points.

New Terminology.

Several new 3D display techniques are being introduced in **V6.50**. These features are not unique to **TNTmips** and, thus, already have names adopted for them by others. However, these names are going to be new to most of you, so here are some explanations.

Billboard Symbols.

Pin mapping is now a familiar term for the users of **TNT** products. It assigns a complex symbol shape at the correct geographic position to selected geographically referenced records in database object. Selected points in a vector object can also displayed in the same fashion. At the present time, these symbols are rendered in 2D and are referred to as billboard symbols. If the view is 3D then the symbol is rendered in the surface plane of the viewing device (perpendicular to your view). If the 3D view moves, as in an MPEG or a simulation, these 2D symbols will rotate around a Z axis always presenting the same width. The height of the symbol will shrink as you pass over it until it disappears when it is behind the view. If the pins are set to be relative in size they will increase in size as your view position approaches them or remain at a fixed size if they are set up to have an absolute size.

Stalked and Rooted Point Symbols.

One visualization problem with billboard symbols in 3D is that you have no visual reference as to where they really are in your flat view. They could be large and merely appear small as they are in a distant part of the scene, or small and appear large as they

are in the foreground. Turning them or changing their size as they are approached would give some clues as to their surface locations. Connecting them to their position at the nadir is another approach. We take many of our visual cues for size from the point where a distant object is connected to the ground surface stretching away from us in perspective, not from our binocular vision.

Billboard symbols can look like flowers so these connections to the ground have been named stalks creating stalked pinmaps or symbols. The military uses stalks for floating military symbol designations as leader lines to their correct position on the ground. In the geospatial visualization in **TNTmips**, controlling how these stalks look can provide better 3D visualizations of database records. Geologists have long been familiar with this kind of 3D view of the colorful columns of coring or borehole data leading down from a point on a transparent surface. **TNTmips** also renders below surface points connecting to the surface and these are called "roots." The effective use of stalks and roots in 3D is illustrated in the attached 2-sided color plate entitled Vector Points on Stalks.

Curtains.

A curtain is another 3D rendering term used to denote the ground trace of an object (such as an aircraft or tornado) that has or is moving across your current view. As the object moves it can leave a track of its path in space and/or on the surface of your static or moving view. However, the surface may already have many other line elements such as roads and rivers that can be confused with these traces. An optional way to draw attention to this track in your 3D space is to create a transparent curtain between the ground track and the air track of the event. These curtains can come and go and change color as they relate to where they are relative to your path (for example, the color could show the possibility of your intersection with them). Curtains have long been used in 3D presentation of underground geologic stratifications where many different curtains are presented representing faces connecting known occurrences, for example, the depth to a layer in a core or outcrop. Curtains have as yet only the most rudimentary representation in the **TNT** products as profiles.

Extruded Polygons.

2D geospatial systems often have layers containing points and polygons with attributes that can be more readily interpreted in a 3D view if they are colored, shaded, and extruded up out of the surface. Stalked pinmaps are a simple means of extruding point elements. Raising up a polygon to a height specified by an attribute is referred to as an extruded shape and can now be added to 3D static views and MPEG movies by the **TNT** products.

The following is a reference paper providing a good overview for the use of these and other 3D component terms in military applications. It provides a good summary of the military approach to such simulations where, just as in geospatial rendering, realism is not necessarily the goal. Just as the title implies, a realistic rendering of a scene with hidden and camouflaged threats is not as valuable as one with stalked symbols showing their locations. The title of this article might be just as appropriately applied to the objectives of many of your geospatial renderings.

Visualization for Situational Awareness. IEEE Computer Graphics and Applications. September/October 2000. by Eliot Feibush, Nikhil Gagvani, Daniel Williams. pp. 38-45.

Abstract: Visualization techniques in a situational awareness system aid rapid comprehension of a complex battlespace. Hardware scalability lets remote users share situational awareness with the command center.

Extruded Polygons.

Introduction.

A variety of extruded shape special effects can now be added to your renderings of 3D perspective surfaces or MPEG movies using polygons selected from vector overlays. These extruded shapes can be colored by using separate style assignments for their tops or roofs and for their walls. The sun position can be specified so that the walls of the extrusions can be shaded, including curved shading for curved extrusions such as cylinders created by extruding circles. Extrusions can be vertical and parallel or perspective and flaring (the usual case). An attached color plate entitled Extruded Polygons in 3D View provides examples of some views with extruded polygons.

Flexibility.

The attribute providing the height of the extrusions can be referenced to sea level or the surface. Buildings with changing shapes can be represented, such as a smaller upper-level cross-section, by piling up the extruded polygons representing these levels. However, since the current 3D rendering method does not permit transparency in the draped surface, solid structures extruded below ground, such as geologic cores, must be viewed by looking under the edge of the 3D draped surface.

Wireframe Design Mode.

When working on a design in wireframe mode the extrusion sides and tops cannot be readily separated from the background wireframe unless the extrusion lines are in color or the shapes they represent are rendered in a color. For the purpose of quick design, you can choose a solid color in the wireframe mode for each polygon set. You can use a different color for those above the surface and those below. These colors can be conveniently chosen from a palette by using the 2 color buttons in the wireframe panel. Use them until an appropriate style assignment is made for simple color polygon renderings such as 3D histograms. The attached color plate entitled More Extruded Polygon Effects shows color-shaded cylinders that extend above and below the vector surface.

Setting Heights and Depths.

In a geospatial application a polygon traces out an irregular elevation on the DEM used in a 3D rendering. The extrusion process automatically determines the minimum and maximum height of each polygon's surface trace. You may have measurements of building height on slopes referenced to either of these values (for example, a 1-story house with a walk-out basement). When the polygons are extruded you can specify that the height value be measured from the minimum position or the maximum.

Attribute fields are used for the height of the extrusion above or below a sea level value or the height of the surface. A units option menu is provided to assign measurement units to each attribute field selected for extrusion. Computed fields can be used to scale attribute fields before extrusion or to combine them for some special purpose.

Coloring Walls.

The styles for the color of the walls of the extruded polygons can be selected from the familiar **TNT** options: All Same, By Attribute, By Theme, and By Script. All Same will create uniform color walls for all selected polygons. By Attribute will vary polygon side

colors by the selected attribute field. By Theme will horizontally stripe the wall of the polygon with a different color for each vertical step in the interval. By Script will let you set the wall color by query.

Coloring Tops.

The styles for the color of the top of the extruded polygons can also be separately selected using the same procedures as for the walls.

Setting Shading.

A sun position can be interactively selected to set the shading for the colors of the walls and tops of the extrusions. If a wall is curved the shading will vary smoothly along it. You might wish to create your extrusions over a black and white or color coded 3D rendering of a shaded relief map. Examples of how to create these attractive representations of elevation surfaces can be found in the enclosed QuickGuides entitled Relief Shading and Color Relief Shading.

Setting the sun position for extruded polygons uses the same interactive graphic as setting it for the relief. It would be desirable to have the same shading of the relief surface as for the extruded polygons. You can do this by setting the black and white or color surface relief shading to match at the same time you set the polygon sun position. If you do this, any surface shading you have already set for the elevation surface will be temporarily altered to match the polygons as the surface is draped into the 3D view.

If the surface is draped with an image it will already represent a fixed sun angle and contain shadows. You may or may not want to set your sun angle to the same position for your extrusions. If the image was collected with a high sun angle, thus creating short and inconspicuous shadows, you could introduce new shading into the view by setting up to incorporate the relief shading of the DEM into the image at the same sun angle as the shading of the extrusions.

Stalked Symbols.

Stalks for billboard symbols are set up similarly to extruded polygons. However, they are not extrusions but lines drawn according to the selected line style. Stalked points use the Style from the Points tabbed panel for the billboard symbol. Just as with extruded polygons, you have the usual 4 options for determining line styles: All Same, By Attribute, By Theme, and By Script.

Attribute fields are used to specify the length of the stalk at each point above or root below a sea level value or the height of the surface.

In wireframe mode, while establishing scale and viewpoint, it is difficult to tell stalk lines from wireframe lines. Thus stalks and roots are each assigned a separate default color and width. Use the color boxes provided in the tabbed panel to change from these colors if you want other colors for stalks and roots in wireframe mode.

A units option menu is provided to assign measurement units to each attribute field selected for a stalk or segment. Computed fields can be used to scale attribute fields for stalk length or to combine them for some special purpose.

Vector to Raster Conversion.

Additional points are automatically inserted along each vector line or polygon edge to better define it as it is being converted to a raster. The density of the points is determined by the cell size of the raster required. This improves the representation of lines and edges when a high resolution raster is created from a vector object.

Buffer Zones.

Your progressively more advanced applications have begun requiring more kinds of buffer zones. Previously you had to make repeated passes and use other operations to prepare multiple buffer zones for the same elements. Now you can use a single buffer zone operation to obtain multiple, evenly spaced or unevenly spaced buffer zones with correct topology. More flexibility has also been added so that you can designate how buffer zones for islands are created. An interesting footnote is that these improvements were added in response to several client requirements related to problems experienced with other competitive systems. Our clients and prospective clients using these other popular products were experiencing complications in using them to compute buffer zones. Typical problems encountered were:

- too many total elements were input and the product stopped and reported this;
- the topology was too complicated and the other product simply quit; and
- only 1 buffer zone processed per pass requiring multiple passes which resulted in topological problems when they were later combined.

All these problem data sets were provided to MicroImages along with their required processing goals. After some refinement of the buffer zone process, all were successfully imported and processed as required and exported back to their originating systems. It was also clear from comparative buffer zone runs made between these other products and TNTmips, that running buffer zones in TNTmips on several hundred thousand elements is much faster. It appears that these other popular products are cutting corners in this area as they try to make their products increasing easy to use for simple tasks using non-topological data structures. More complicated applications thus end up slower, failure prone, and struggling to deal with more complicated topology.

The attached color plate entitled Multiple Buffer Zones and Buffer Polygons with Islands illustrates these new options.

Multiple Equal.

Equal step buffer zones can now be computed in a single pass. You are able to specify the starting buffer distance, the ending buffer distance, and the distance between equal intermediate steps.

Multiple Unequal.

You may also specify that a sequence of buffer zones be computed at a series of unequal offsets that you enter. These might be distances specified in some regulation, ordinance, or law. They might also be some other progression you derive elsewhere, such as equal area between buffers, doubling of the area between, a logarithmic area accumulation, and so on. Multiple unequal buffer zones are particularly useful when considering the impact on land use of existing or proposed regulations such as the noise reduction with distance from a highway, the migration of a pollutant, and so on.

Inside/Outside.

Options can now be set to control how buffer zones are created for multiple nested islands. Previously you would have had to be able to use a query to identify these polygons and run them as separate passes. For example, suppose you have polygons representing the edge of the water of a lake, its island, and a pond on the island. A shoreline buffer zone for the lake and the pond should be outside their water boundaries but computed for the inside of the island water's edge boundary. Another choice might be

to ignore or omit buffer zones for any islands as they are inaccessible for the practice being studied. A third would be to place the buffer zones outside all polygons regardless of their status as islands within islands or not. Other combinations are also possible.

Attributes.

The buffer zone polygons now automatically generate a “Buffer Table” for multiple buffer zone calculations. This table has 2 fields: Distance and Interior. The Interior field indicates the side of the polygon that has a buffer zone with distances less than the given Distance field. In the future, the Buffer table can have extra attributes as requested.

Optimized.

The vector objects created by this process are now automatically optimized.

Georeferencing.

You can create more than one georeference for an object as you work with it for various valid reasons. However, often you do not want to do this without careful consideration. Now when you save a new georeference object, and one already exists for that object, a warning message will be displayed. You will be asked if you wish to replace the existing georeference with the new one or add it. It is hoped that this will help to prevent most of the confusion arising from having multiple georeference subobjects for a single geospatial object. If you are not aware that multiple georeferences have been added, then you often automatically select an incorrect one for your current activity and layers will not line up.

Connection to a digitizer via WinTab has been improved so that communications and operations are more reliable.

The “Namibian Map System” has been added to the list of built in coordinate systems.

Automatic Raster Combination.

This new process outputs a single raster from a set of source rasters where each cell value in the new raster corresponds to a unique combination of cell values from the input rasters. This operation is analogous to a “join” operation on a set of database tables. Each new cell value will have an associated attribute record with fields containing the corresponding input raster cell values as well as the count of cells having that combination. All raster types including RGB and complex may be used in that combination, however, the source rasters must all have the same dimensions (lines and columns).

The following table shows a partial result from a combination of possible classifications for several dates.

Result	Count	Class 1998	Class 1999	Class 2000
1	34	3	3	100
2	81	2	3	100
3	1442	2	3	11
4	1179	2	5	11
5	1166	2	10	11
6	389	3	5	11
7	28	3	1	100
8	108	2	5	100
9	342	3	10	11
10	168	3	20	11

11	287	2	1	13
12	162	5	10	11
13	1514	2	3	13
14	31	5	3	11
15	198	5	3	500
16	454	2	1	12
17	1183	2	3	12
18	156	3	10	500
19	323	3	3	12
20	1835	2	5	13
21	1916	2	5	500
…				

Of course, the number of combinations may become quite large and therefore an option is provided to warn you if the number of combinations exceeds a specified value. The number of combinations affects the size of the resulting raster and the size of the associated attribute tables. If the number of combinations is large, the resulting raster and database can easily exceed the total size of all the source rasters.

An option is provided to transfer additional attributes, if any, from the source rasters to the result raster database. This is useful if the source rasters are the result of a classification or feature mapping operation. These attribute tables will retain their original structure and will have attachments from the result raster cell values to the corresponding records as needed.

An additional option is provided that allows the transfer of color information from each input raster to the new raster. This feature is only available if the number of combinations is less than 65536 (64K) as that is the maximum allowed number of colors in a color palette (at present). For each source raster containing color information, either via color palette subobjects or as RGB cell values, a color palette subobject will be created for the result raster. This color palette will have an entry for each resulting raster cell value. This feature permits the selection of a color palette when viewing the new raster in order to show it in a meaningful way. If the color palettes for all input rasters are saved, then the new raster can be viewed with each palette and will look identical to each input raster. In most cases, viewing the result raster as grayscale will not be meaningful as there is no inherent order to the result raster cell values.

This process is accessed via Process / Raster / Combine / Automatic on the TNTmips menu. Its simplest application is illustrated in the attached color plate entitled Automatic Raster Combination.

Geospatial Formula.

Improvements.

When first started, a dialog will now be displayed that asks if you want to open an existing formula, create a new formula manually, or create a new formula using the “wizard.” The first two choices are equivalent to the previously existing options on the “File” menu. The option to create a formula using the wizard is explained below. The attached color plate entitled GeoFormula Creation Wizard illustrates the steps in this approach.

There is now an icon toolbar that includes buttons to create, open, save and run the formula, simplifying access to these frequently used operations.

The “Objects” and “Values” pages have been changed slightly to have a single toggle for “Show Details” instead of having a toggle for each Object and Value in the list.

An option will now allow you to match any reference raster by size, extent, and orientation. This makes it much easier to use GeoFormula to compute a new raster that is then used in combination with existing rasters for display or further computation.

Multi-Criteria Decision Analysis (MCDA).

It is now possible to create GeoFormulas for “Multi-Criteria Decision Analysis” (MCDA) using the new GeoFormula wizard. In MCDA, each input object (raster or vector) is assigned a “weight.” Then a “score” for each object is computed using either the cell value (raster only) or any associated attribute (both raster and vector). The weight is fixed for the entire object while the score varies based on cell/polygon location. The formula result is computed by multiplying the weight for each object by the score for that object and summing the result for all objects.

The GeoFormula wizard also allows a score table to be filled in within the wizard and provides tools to select an attribute to be associated with the score. This is especially useful when there is no existing numeric attribute to use as the score. When filling in the table, any existing attribute may be chosen to relate the score to. For numeric attributes, an option to assign scores automatically created for each range or unique value is available. An entry in the table is automatically created for each range or unique value and the scores may then be easily filled in.

After the wizard finishes, the process returns to the main GeoFormula window where the formula may be run immediately. If desired, the weights may be easily edited on the “Values” tab and the script that the wizard creates for the MCDA process may be examined and altered as needed.

The attached color plate entitled Multi-Criteria Decision Analysis illustrates a simple application of this new kind of GeoFormula. The following book is a new and detailed reference on the extension of geospatial data into these decision making procedures.
GIS and Multicriteria Decision Analysis. by Jacek Malczewski (Department of Geography) University of Western Ontario, 1999 John Wiley and Sons, Inc., 392 pages.

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3. Introduction to Multicriteria Decision Analysis
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Part II: Spatial Multicriteria Decision Analysis
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Part III: Multicriteria - Spatial Decision Support Systems

9. Spatial Decision Support Systems
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10. MC-SDSS: Case Studies
    Land Suitability
    Habitat Restoration
    Health Care Resource Allocation
    Planning Support System: Water Resource Management
    Site Selection Problem
    Reorganizing Fire Protection Services

Viewsheds.

It is now possible to create a viewshed and choose whether the viewshed or the area outside the viewshed is transparent.

A viewshed can now be computed for multiple points, which can be used to define a linear or area feature. When multiple points are input, this process does not recompute for each point but uses a more complex approach. Thus, multiple point viewsheds can be computed in a single pass without waiting for long sequential passes.

Import/Export.

Import Rasters.

CTG LULC.

USGS's Landuse Landcover Composite Theme Grid raster format can be imported.

SURFER.

Golden Software's Geosurf ASCII, 6, and 7 .GRD raster formats can be imported.

GeoTIFF.

The GeoTIFF specifications do not support images that have control/tie points but for which no projection is included in the header. Unfortunately, illegal GeoTIFF images of this type are being produced by other software products. Georeferenced raster objects can now be created from these illegal GeoTIFF files if you know and enter the identification of the projection during import.

NITF.

The reference point used for the cell at the origin of the georeference has been shifted from its edge to its center as per the specifications.

ArcGrid.

ESRI's ArcGrid binary raster format can be imported.

ASTER.

NASA's Aster HDF raster format can now be imported.

Export Rasters.

GeoTIFF.

A number of free GeoTIFF viewers have problems with imagery which requires rotation, lateral shearing or rubber-sheeting to transform the raster image coordinates to and from projected map coordinates (model coordinates). However, the GeoTIFF specification fully supports and allows such transformations to be specified (other than details on rubber-sheeting). Since the TNT Products fully support large numbers of Ground Control Points (GCPs) as well as image rotation and shearing in a completely transparent fashion it is possible to export imagery to GeoTIFF which does not correctly display in some viewers which only partially implement the GeoTIFF standard.

To export data for use in these low-end viewers it may be necessary to first resample the image in TNTmips to remove any rotation and shearing. This can be done using the Process / Raster / Resample / Automatic... selection from the main TNTmips menu. Make sure the Orientation option is set to "To Projection."

The following is reproduced from the GeoTIFF Format Specification as a guide to how an export process should define the image to map model transformation in GeoTIFF.

Identify the nature of the transformations needed to tie the raster data down to the model space coordinate system.

Case 1: The model-location of a raster point (x,y) is known but not the scale or orientation:

Use the ModelTiePointTag to define the coordinates of the known raster point.

Case 2: The location of three non-collinear raster points are known exactly but the linearity of the transformation is not known.

Use the ModelTiePointTag to define the coordinates of all three known raster points. Do not compute or define the ModelPixelScale or ModelTransformation tag.

Case 3: The position and scale of the data is known exactly, and no rotation or shearing is needed to fit into the model space.

Use the ModelTiepointTag to define the coordinates of a known raster point and the ModelPixelScaleTag to specify the scale.

Case 4: The raster data requires rotation and/or lateral shearing to fit into the defined model space.

Use the ModelTransformation matrix to define the transformation.

Case 5: The raster data cannot be fit into the model space with a simple affine transformation (rubber-sheeting required).

Use only the ModelTiepointTag and specify as many tiepoints as your application requires. Note that this is not a baseline GeoTIFF implementation.

Experimentation with the free viewers from USGS and PCI Geomatics has revealed that both of these products only support case 3. It is also known that versions of ArcView prior to ArcView 8 do not support rotation in imagery and will either ignore any specified rotation or report an error.

When exporting using TNTmips, case 1 does not apply as TNTmips does not at present allow a single point to be used for geocoding. Depending on the number of control points and georeference model specified in TNTmips, any of cases 2-5 may occur when exporting. Although an option is provided to force the export to use the case 3 option of no rotation/shear this may result in undesirable displacement between image and map coordinates. It is therefore recommended that rasters be resampled as noted above before exporting if the image is to be used in other applications which do not fully support GeoTIFF as described.

For more information on the GeoTIFF specifications consult http://www.remotesensing.org/geotiff/geotiff.html

CAD Import.

Shapefiles.

Export to Arc Shapefiles now retains the default setting and sets the “export to decimal degrees” toggle.

Vector Import.

TIGER.

TIGER data for 1998, 1999, and 2000 were modified by the addition of many more attribute tables. All these formats and tables can now be imported and more appropriate relational table links are formed during import.

Suppressing Standard Tables.

Recomputing and writing the element ID and standard tables during import of a large vector object takes significant time. Often when you import to a vector object you know that you do not need or are not ready to use these tables. You can decrease object size and improve the time to import and subsequent performance if these tables are not generated. The default condition is to generate these tables.

You can now set an option for each vector object via the **TNTedit** “Layer / Properties” menu to tell a process to maintain the element ID and standard attribute tables. You can then decide at what point in its use your vector object needs to maintain its element ID and standard attribute tables.

Print to PDF.

CAD and vector data exported to Adobe PDF format can be in the compressed PDF format. This was first available in V6.30 but was never referenced in a MEMO.

Inspect File.

Many so-called public, documented geodata formats are widely abused by both their creator/publisher and others who use them. The publishers add conveniences to the format to accommodate special cases and do not document them out of laziness or in an effort to confuse others who use their formats separate from their products. (Micro-

Images extends the TNT Project File format periodically, but it is not a public format.) Another source of confusion is that software vendors do not craft their exports to carefully create all needed elements of the format. Often this means that "standard" geodata in this format may work in some programs and not in others. Finding these aberrations or simply dissecting an unknown geodata raster can be a frustrating process where you usually get no help from the software's vendor. However, you can often help yourself and get the vendor's attention if you can more closely determine what the problem is.

A new process called Inspect File has been added to **TNTmips** to help you dissect any geodata file. Its uses can be technical in nature and may require programming skills. The simplest application would be to find the parameters defining an image in a file known to contain an image(s). You need to determine this information to import the raster with **TNT**'s generic raster import process. Another simple application would be to determine that some fields in the header of a raster are missing or in error. An attached color plate entitled Inspect File Shows File Contents illustrates a simple application of this type. If you have some programming background, you can drill into more complicated geodata formats with this technical tool. An attached color plate entitled Using Inspect File for Raster Import describes this application.

This new Inspect File process is located at Support / Inspect Files.... It can inspect the contents of any file in a variety of data type formats: ASCII, EBCDIC, signed and unsigned 8-, 16-, and 32-bit decimal, IEEE 32- and 64-bit float, and VAX 64-bit float. ASCII content can be displayed using characters or localized codes for special characters in other languages, or in a hexadecimal display format. The decimal types can be displayed in binary, octal, decimal, or hexadecimal. All multiple byte types can be displayed with hi-lo or lo-hi byte ordering. The process can also split the file into multiple records for simpler display.

Removing Map Collars.

USGS distributes topographic maps in a Digital Raster Graphics (DRG) format. These United States digital topographic maps start at scales of 1:24,000 and can be downloaded without charge for use as base maps. DRG files are direct scans of the corresponding printed paper map and contain its collar, which is the white border containing metadata, scale bars, border coordinates, and legends. To assemble these maps into larger units or for the display of several in a TNT view, this collar area must be accurately removed.

MicroImages wished to use the 1200+ 1:24,000 scale USGS maps as a layer in the Nebraska Statewide online atlas. To do this, a process was implemented to convert the DRG imported into a raster object and accurately trim its collar off and save the new raster object. You can process as many input rasters as you wish at one time. This specialized process is now available for others to use at Process / Raster / Utilities / Extract and Trim DRGs.

Vector Validation.

The attachment type of database tables will now be automatically changed from "No Restriction" to "Related Only" if no graphical elements in the vector object are directly attached to any records in the table. This status information will speed up query operations, which can skip searches for graphical elements in tables that have none attached.

Importing vector objects or creating them in the Edit process automatically creates IDs and standard tables for the elements unless you turn off that property for the object. Vector validate will also skip this activity unless the option to compute these properties is on. When you do wish to create the standard tables the best way to do so is to change this property of the vector object before validation. Doing this as part of a validation will also ensure that the topology is correct as well as yielding correct current tables.

Network Routing.

The network analysis algorithm for calculation of routes between source points and multiple destinations points was improved. It will now choose source points or destination points to start from, whichever are fewer in number.

Legend Design.

* Raster Legends.

A new "Color Scale Ranges" legend type is now available for use with imagery displayed with a continuous color palette. You can use this new legend type in LegendView or in your layouts. You choose the number of legend entries desired. The legend created divides the raster's data range into that number of steps. A column of an equal number of legend boxes is created and labeled with the data range it represents. Each of these legend boxes is filled with the color in the raster's color palette representing the midpoint of the data range for that legend box. An attached color plate entitled Color Scale Ranges illustrates this new legend type.

Tabs.

Tab stops can now be used to structure the legend layout and text.

* Mixed Text Styles.

You can now assign mixed text styles and sizes to legends in layouts containing 1 or multiple objects. More attractive legends can be created by judiciously using appropriate text styles, fonts, and sizes to organize legends in a pleasing hierarchical, multicolumn format using tab stops. The attached color plate entitled Text Styles in Multi-Object Legends illustrates an attractive legend layout using these kinds of features.

Miscellaneous.

Unused horizontal and vertical guides can now be deleted.

Raster sample legends in layouts now work as elsewhere, such as in LegendView.

Spatial Data Editor.

Background.

Expanding Need.

Creating clean, accurate, original geospatial data continues to be a priority in the evolution of **TNTmips** and **TNTedit**. In the United States, Japan, and Europe there are large industries centered around the development and sale of basic geospatial data ranging from detailed street maps to high resolution color orthophotos. In some cases, national programs provide these geodata sets free or for the cost of their reproduction to anyone to further national goals (for example, TIGER 1:100,000 county maps or LANDSAT 7 images). These free, base layers provide the starting point for creating special, up-to-

date materials of a specific and proprietary nature, such as annual land use changes, route maps, agricultural crop distribution, county tax maps, even to the level of mapping variation in an individual agricultural field. In many other nations these standard geobase materials are not publicly available due to economic or national policies. Under either situation, many GIS applications for planning and resource management are unique and require the assembly of specific materials for use with or without these standard geodata base layers.

Start Where Appropriate.

CAD programs are widely used to create drawings and are frequently applied to creating rough drafts of layers for use in a GIS. MicroImages recommends in most cases that you will find it more efficient to create a layer as a CAD object in the editor and then process it into a topological vector object. This would be the best approach to creating a completely new layer by interpreting boundaries and features from an orthophoto. As you conduct your initial image interpretation, it is easiest to simply draw the lines in the CAD editor or with the sketch tool in the GeoToolbox. Concentrate first on the accurate image interpretation while using simple tools to capture only the boundaries. Subsequently you can convert the CAD object to a vector object, overlay it on the same image, and apply filtering and manual adjustments to clean up its geometry. In this step, you concentrate on its accurate positional and topological properties. Finally, as a third step, the topologically correct polygons, lines, and points can be carefully labeled with their attributes with reference to the underlying image and other available reference layers.

Create Clean Geodata.

Once you are familiar with all the capabilities of the Editor, you can design optimal procedures for the creation of your graphical layers from your source materials. It will then be apparent that you need a wide range of tools and techniques to create clean and accurate results that can be used with other available layers. Eventually you will use many layers in the Spatial Data Editor and often start with importing and georeferencing image and graphical layers from other sources. Many of the other layers you use will have been created by others with other tools and can often be historical in nature, out-of-date, or simply inaccurate. As the end uses of your geospatial data become complex, you will find that you must become progressively more sophisticated in the creation and maintenance of these layers and their attributes. You will also find that it is difficult to avoid some detailed manual work to finalize clean, accurate layers. MicroImages continues to monitor the nature of the use of the Spatial Data Editor and your suggestions for improved tools. The single feature most requested until recently was for an UNDO capability, and this was introduced in prototype form in **V6.40** in a parallel version of the Editor. In **V6.50** this is now the only version of the Editor released and has been enhanced with several new features. Keep your suggestions coming and those of general interest will be addressed wherever possible.

* Restore Edit Sessions.

Introduction.

You can now save and load edit sessions as a specific group. Saving the group you were editing was a widely requested feature. To save a group, use “File / Save Group...”. To open or load a previously saved group, use the “Open” icon or “File / Open” menu selection. Opening a saved edit session will involve locating and setting

up layers only if you have moved any of them. An attached color plate entitled Save/Restart Complex Editing Session describes this new feature.

Uses.

Now you can open a new large X server workspace for use with the Editor, open a large display window, add several layers into its view, and conveniently situate all the needed windows, dialogs, and tools in this workspace. This takes time. MicroImages will make your setup easier with planned future improvements in **TNT**'s use of the large workspace (for example, by opening a new display group to scale in the workspace). For various reasons you will want to save and restore edit groups in your workspace. You may know that the editing you have underway will span several sessions. You may want to use the current session as a template for editing identical materials for a series of similar objects. For example, you are updating existing layers as overlays on a series of DOQs. Or, perish the thought, you may crash the Editor (of course you are doing frequent saves of your editable layers) and want to quickly restore the session to the same condition as when you last saved the editable layer.

Edit sessions are saved as display groups to which information has been added to identify editable layers. As a result, this same capability is available to restore a previous display group into a large workspace. The saving and opening of a group in the editor will setup the reference layers and any editable layers in the group. However, if the group was saved in a display session, you can load it in the editor but it will have no editable layers. You will then need to load or designate those layers you wish to edit.

Constraints.

If you move geodata objects or their Project Files around that are members of a display group or edit session, they may not be found at their new location when you attempt to load or restore the group. Under these circumstances, you will need to navigate to and relocate the object or file as part of the restore operation. If you use objects referenced in a saved group in other **TNT** processes, you may alter them so that they can no longer be loaded in that group's restore operation, although this is unlikely.

Unfortunately, it is not yet possible to preserve your UNDO/REDO options with a saved group. A series of UNDOs on each layer builds up a large temporary file for each layer (especially with raster edit operations). Since hard drive storage is now cheap, saving all this UNDO material would simply require waiting the additional time to record them. However, for speed, the UNDO strategy requires knowing the precise history of the exact file location of the blocks making up each layer for each edit step so they can be restored from the UNDO files.

REDO.

UNDO permits you to backup multiple steps for any operation on any layer currently in your composite view in your edit session. REDO restores the last UNDO step you performed on any layer you select as active for editing. A REDO can be performed on that layer even if you have been editing some other active layer. For technical reasons, only one REDO step is provided for each layer. REDO restores every kind of change to the layer, including alterations to associated attribute tables. An attached color plate entitled Undo/Redo Edits In Multiple Layers illustrates a redo operation.

Tool Control.

You can now specify whether or not to clear (remove) a tool graphic when using it to add elements. This aspect of your editing can now be set using "Setup / Preferences…"

for each layer type (CAD, vector, raster, or TIN) on its panel. For example, if you wish to duplicate a circle element at several locations you can do this by removing the preference to automatically clear it. You can then draw the circle, and move and insert it at several locations.

Drawing Margin.

You have reported that it is sometimes difficult to create, manipulate, or add elements right at the edge of your group. It is even possible that you wish to draw outside the edge of the layer, which is also the edge of the viewable group. A new margin control can be used to enter a distance that will set up an additional margin area around the group for use in editing. This margin distance is set in "Setup / Preferences..." in the "View" panel. An attached color plate entitled Setting a Group Margin Distance illustrates its use.

X-Y Digitizers.

WinTab support of digitizers has been improved to be more reliable. WinTab support is now standard and provided by their manufacturers for all new digitizers. Dropping support for older, non-standard X-Y digitizers in **V6.60** will allow MicroImages to focus on further improvements in X-Y digitizer support in the **TNT** products.

Note! Unless this will pose a serious problem for you, MicroImages will drop direct support of X-Y digitizers in **V6.60** and support only those digitizers using WinTab.

Editing Vector Layers.

Optimization.

Now the default option, when you save your edited vector, is to optimize it for more rapid use of sub-areas of it in other processes such as in a zoomed in view. If, for some reason, you do not wish to optimize a vector object, this action can be shut off using the "Setup / Preferences..." dialog in the Vector panel. The object can then be optimized later, in the optimization process or some other process.

Suppress Computing Standard Tables.

Recomputing and writing the element ID and standard tables for a large vector object takes significant time if you are frequently saving your work or using other analysis processes. Often you are not ready to use these tables anyway as you know that the creation, edit, or cleanup of the vector object is incomplete. You can decrease object size and improve performance if these tables are not computed until needed. The default condition is to create these tables. However, you can also turn off this option for each vector object via the "Layer / Properties" menu. You can then decide at what point in its use your vector object needs to create and maintain its ID and standard tables.

Convert Nodes to Points.

Nodes can now be converted into points. This requires the simple action of attaching a database record from the point database to the node. The table used for this record can be the point Element ID table or some other table containing the attribute you wish to attach. After conversion, a node with a record attached is treated as a point for display and other purposes. However, if the lines attached to the node are removed in

some subsequent edit operation, the node is retained as an actual point element. An attached color plate entitled Convert Nodes to Point Elements illustrates this new feature.

* Snap to Other Layers.

Commonly you keep various types of elements for various themes in separate vector layers. During editing you find you want to start or terminate a new line element on an element (point, line, or polygon) in another CAD or vector layer added to the group. A common example is when drawing property edges or other lines that will be terminated by a river or coastline in the hydrology layer. Previously you simply got as close in the view as possible or created everything in 1 layer and extracted from it later to various theme layers. Now you can snap the beginning and ending of your line to an element in another graphical layer. In the vector editor "Add Line" dialog, there is a "Snap Layer..." prompt that defaults to the current editable layer. Simply press this "Snap Layer…" button to select another vector layer in your view. Now your snap action will close to the nearest specified element type in that layer. Whatever options you have set up in your snap operation such as element type, snap geometry, … will apply in this operation. An attached color plate entitled Multi-Layer Snapping Options illustrates the use of this new feature.

Tracing.

Tracing is an additional feature planned to allow you to copy or trace a portion of an element from one layer to the current edit layer. Tracing or copying part of an element in a reference layer will permit you to exactly duplicate a portion of a line or polygon needed from another layer. In the above example, and the associated color plate, both sides of a property boundary are snapped to a river in the hydrology layer, thus closing the lines on this boundary. The next step would be to exactly trace that portion of the river into the property layer thus forming a polygon in this layer. This feature is planned for release after **V6.50**. If you need it now, please check on its status with software support.

Snap Arcs.

Arcs are frequently present in imported CAD layers (corners, fillets, rounds, …) but often do not connect with the adjacent line features (they just look like they do when plotted). This is okay in a CAD layer, but these arcs will present a topological issue that must be resolved when it is converted to a vector layer. Previously the "Add Arc" tool would use the line snapping parameters to extend the arc. Now special arc snapping parameters are available to control how a selected or new arc is extended and snapped to another element in a vector object. This is not necessarily as simple as advancing the end of the arc, as the other point or line may not fall on the extended arc. For this reason, the default for extending or adding new arcs is to snap to nothing.

Connect Points.

Recently MicroImages has been answering more requests on how to link a series of points into a line or a polygon. More and more of you are collecting point data for varying purposes and bringing it into **TNTmips**. Creating useful geodata from these values can be complex. In each case the solution may depend upon the order the points were recorded, their current format, the attributes available to identify their order and association, … There may not be an automated solution to joining your points unless you have control of their collection so they conform to one of the formats or tools supported by the **TNT** products. Solving your unique complex point import, interpolation, and linking

problem is an ideal application for an **SML** script. Another approach would be to use the point tracing tool provided in the Editor. An attached color plate entitled Connect Points Editing Tool illustrates the application of this approach.

Extending Lines.

Existing lines can be selected and extended by snapping. You may want to simply add to the existing line (for example, a road has been extended). You can also extend either end of the line as a new type of line (for example, a road extension that is of a different surface and category). You can also extend the line in a different category and snap it to another feature (for example, as a new bridge across a river that now connects a formerly dead end road to an existing road on the other side). A color plate is attached entitled Chain Snapping Extends Line Elements to illustrate this tool.

* Label Along Curved Lines.

Creating labels that follow the curvature of a line is now available in the "Set Line Labels" and "Auto Label Generation" tools. Three types of line curvature are supported including "Exact," "Spline," and "Straight" fit. Straight fit does not follow the line curvature; it selects the best angle to use in labeling the line. Exact fit follows the line "exactly." However, depending upon the curvature followed, some letter collisions may occur with this mode. Spline fit uses the exact fit method to generate the length of the baseline for the label and then performs a spline on the baseline to smooth out the sharp changes. The offset placement of the labels in relation to the line can be set through the style assigned to the label. The "Vertical Alignment" menu provides "Bottom," "Center," and "Top" selections for the label style.

Label Orthogonal to Lines.

The "Set Line Label" and "Auto Label Generate" tools now also have an option to create labels that are orthogonal to the line that is being labeled.

Editing CAD Layers.

Multiple Element Constructs.

Addition and manipulation of multi-point, multi-line, and multi-polygon elements is now provided. A multi or combination element is a CAD element that consists of multiple elements but is being treated as one element with respect to database attachment, style, and statistical information. CAD blocks are 1 type of multi-element feature in CAD drawings. ArcView Shapefiles also contain multi-point, -line, -polygon elements and MicroImages is also preparing for their direct editing via this feature in the CAD Editor.

Exploding CAD Elements.

The ability to explode certain CAD elements is now available. This operation takes a composite element (multi-point, -line, -polygon or inserted block), and "explodes" it into its constituent elements. Therefore, a Shapefile multi-point element becomes multiple point elements, and an inserted block is deconstructed into its point, line, and polygon components. To get at this feature, click on the "Edit Elements" icon in CAD Tools window. Then choose the "Explode" operation icon in the Element Selection window (after selecting the multi-element). An attached color plate entitled Explode Composite CAD Elements illustrates this operation.

Transfer Labels to Polygons.

Vector and CAD labels can now be converted to vector polygon attributes using Process / Vector / Attributes / Transfer Attributes. The labels are converted into records in a database table and attached to the polygons.

Spatial Manipulation Language (SML).

Introduction.

A collection of 42 new functions has been added to the **SML** scripting language. Most of these were added to permit **SML** to create MPEG or AVI movies. With these functions your script can take any of your geodata in Project Files and select, process, and combine it to generate a movie frame. You can generate a complete movie if the script iterates through the process while computing new view parameters or content for each new frame.

Many kinds of movies can be computed from your geodata. A complex example of interest to one client is to compute frames of a movie while collecting sensor data whose changing values will be pin mapped into each frame. Each pin's appearance will vary according to sensor values collected in a table. The geodata used in your movie could be altered for each frame, such as in a time lapse movie loop. This could be as simple as changing the viewshed computation position along a road for each frame or changing the vertical position of the viewer for a fixed viewshed position. Functions are also available to control the viewer's position and direction for each frame. These can be read from a file, such as a file of readings from a GPS unit or some other source. They can also be computed, such as the spiral flight path used in a sample script. Computing movies in **SML** can be used to create many kinds of geospatial special effects for use in your PowerPoint presentations.

Localizing

You may wish to prepare **SML** scripts that operate in another language. Adjustments have been made so that **SML** is fully internationalized. Now you can create a specialized product to solve a specific, local geospatial application for direct use by those who speak only a single national language. It is unlikely that any other robust geospatial programming language provides this ability to reach a local population with easily understood applications.

Input and output strings originating from **SML** functions, such as from errors, are now automatically translated by the selected **TNT** language resource files. However, the text you generate within the script for use in your windows, dialogs, and so on must be included directly in the script in the chosen language. The color plate attached entitled Localizing SML Scripts provides guidelines on preparing a script for your language or for translating an existing script to another language.

Sample Scripts.

Creating MPEG Movies *(must be downloaded)*.

Several small sample **SML** scripts illustrating the creation of short MPEG or AVI movies were prepared after the CDs were duplicated for **V6.50**. These scripts and movies can be downloaded from microimages.com/freestuf/. The 2-sided color plate entitled Movie Generation Scripts presents a sample script. Using your own **SML** scripts to generate MPEG movies can combine geographic data (images, vectors, …), graphics (pinmaps, extruded shapes, …), unusual flight paths (orbiting, takeoffs, …), and other geodata into unique presentations.

Run FRAGSTATS (included on CD).

Background.

Ecologists, entomologists, anthropologists, ethnologists, and many other scientists can use fragmentation statistics when appropriate data is available to characterize the distribution and status of plant, insect, and animal communities and the species that define them. The spatial distribution, size, continuity, proximity, … of these components are used to quantify the community. The dynamics of the community can be studied by using these statistics to monitor their alteration with time, climate, external impacts, and other internal and external factors.

Remote sensing imagery and its interpretation and organization in a GIS system provide the basis for computing community continuity or fragmentation, its changes with time, and the beneficial or deleterious results. These applications range widely from the analysis of plant species dynamics on small sample plots, whitefly spreading in agricultural areas, the large scale U.S. GAP program, to impacts on large regions of shifting cultivation and tropical forest clearing.

For example, using spatial statistics, wildlife managers can determine if a habitat is becoming too uniform or too diverse, broken up, and isolated. Birds and animals may not move between their land cover habitat units if the patches of it become too widely separated or too small. Gaps between isolated small habitat units left to preserve the native ecology can become so large that the populations become isolated leading to isolated gene pools that are too small to sustain a particular species.

Objective.

Fragmentation statistics are used to document how land cover or other geospatial variables are broken up into isolated patches. A patch is a piece of the landscape or other system that is considered homogeneous at the scale of a particular study. However, patches are not necessarily homogeneous entities of the landscape or other systems. For the purposes of a particular analysis, they are those entities that can be defined and reliably measured in a spatial sense. When remote sensing imagery is used to measure spatial variability, patches might be some groupings of the classes resulting from multispectral image classification, change analysis, or even direct visual interpretation. When other geospatial data is used, patches can result from polygon fitting of many individual species observations or even from surface modeling. Patches may also be manipulated to evaluate what would result if the distribution of selected spatial components were altered by buffer zones, morphological operations, or other geospatial actions. For example, what is the fragmentation situation before and after a regulation or financial incentive program creates natural stream buffer zones?

Script.

FRAGSTATS is a public domain program running under DOS to compute fragmentation statistics from a raster whose cell values represent patch membership (for example, classes representing land cover). It can also compute similar statistics for a vector representation of patches. However, usually the conversion or representation of raster cells, such as land cover, in a vector format is more generalized and loses some of its spatial variability.

The FRAGSTATS program was written by Kevin McGarigal, Barbara Marks, and others with the support of several State and Federal agencies. More detailed information about the operation of FRAGSTATS, the source code, the metrics it computes, the

equations, and a manual can be found at http://www.innovativegis.com/products/fragstatsarc/index.html. Additional information can also be found at http://www-unix.oit.umass.edu/~fragstat.

A sample tool script [fragtool.sml] is provided to illustrate how an **SML** script can be wrapped around another program to operate it from within **TNTmips** from an icon on the tool bar. In this sample tool script the FRAGSTATS program is run on a raster object in a Project File to create a file of its fragmentation statistics. These statistics can then be imported into a **TNT** database table and linked to the corresponding land cover units. The script provides for:

- selection of the input raster,
- collecting input parameters required by the other program,
- drawing to define the area of interest (for example, a watershed),
- alternately using a mask to define the raster cells to analyze [use fragstat.sml],
- creating or designating output files,
- running the wrapped program, and
- recording its output.

A further discussion of this sample script is provided in the attached color plate entitled Running FRAGSTATS with TNTmips.

Statistics Computed.

The following metrics are computed for patches in FRAGSTATS and are grouped by subject area:

Scale :	Code:	Metric (units):
Area metrics:		
Patch	AREA	Area (ha)
Patch	LSIM	Landscape similarity index (percent)
Class	CA	Class area (ha)
Class	%LAND	Percentage of landscape
Class/landscape	TA	Total landscape area (ha)
Class/landscape	LPI	Largest patch index (percent)
Patch density, patch size and variability metrics:		
Class/landscape	NP	Number of patches
Class/landscape	PD	Patch density (number/100 ha)
Class/landscape	MPS	Mean patch size (ha)
Class/landscape	PSSD	Patch size standard deviation (ha)
Class/landscape	PSCV	Patch size coefficient of variation (percent)
Edge metrics:		
Patch	PERIM	Perimeter (m)
Patch	EDCON	Edge contrast index (percent)
Class/landscape	TE	Total edge (m)
Class/landscape	ED	Edge density (m/ha)
Class/landscape	CWED	Contrast-weighted edge density (m/ha)
Class/landscape	TECI	Total edge contrast index (percent)
Class/landscape	MECI	Mean edge contrast index (percent)
Class/landscape	AWMECI	Area-weighted mean edge contrast index (in %)
Shape metrics:		
Patch	SHAPE	Shape index

Patch	FRACT	Fractal dimension
Class/landscape	LSI	Landscape shape index
Class/landscape	MSI	Mean shape index
Class/landscape	AWMSI	Area-weighted mean shape index
Class/landscape	DLFD	Double log fractal dimension
Class/landscape	MPFD	Mean patch fractal dimension
Class/landscape	AWMPFD	Area-weighted mean patch fractal dimension

Core area metrics:

Patch	CORE	Core area (ha)
Patch	NCORE	Number of core areas
Patch	CAI	Core area index (percent)
Class	C%LAND	Core area percentage of landscape
Class/landscape	TCA	Total core area (ha)
Class/landscape	NCA	Number of core areas
Class/landscape	CAD	Core area density (number/100 ha)
Class/landscape	MCA1	Mean core area per patch (ha)
Class/landscape	CASD1	Patch core area standard deviation (ha)
Class/landscape	CACV1	Patch core area coefficient of variation (percent)
Class/landscape	MCA2	Mean area per disjunct core (ha)
Class/landscape	CASD2	Disjunct core area standard deviation (ha)
Class/landscape	CACV2	Disjunct core area coefficient of variation (percent)
Class/landscape	TCAI	Total core area index (percent)
Class/landscape	MCAI	Mean core area index (percent)

Nearest neighbor metrics:

Patch	NEAR	Nearest neighbor distance (m)
Patch	PROXIM	Proximity index
Class/landscape	MNN	Mean nearest neighbor distance(m)
Class/landscape	NNSD	Nearest neighbor standard deviation (m)
Class/landscape	NNCV	Nearest neighbor coefficient of variation (percent)
Class/landscape	MPI	Mean proximity index

Diversity metrics:

Landscape	SHDI	Shannon's diversity index
Landscape	SIDI	Simpson's diversity index
Landscape	MSIDI	Modified Simpson's diversity index
Landscape	PR	Patch richness (number)
Landscape	PRD	Patch richness density (number/100 ha)
Landscape	RPR	Relative patch richness (percent)
Landscape	SHEI	Shannon's evenness index
Landscape	SIEI	Simpson's evenness index
Landscape	MSIEI	Modified Simpson's evenness index

Contagion and interspersion metrics:

Class/landscape	IJI	Interspersion and Juxtaposition index (percent)
Landscape	CONTAG	Contagion index (percent)

Farm to Market Routing *(included on CD)*.

No matter how many features are provided in a complex software system such as **TNTmips**, every client is eventually faced with a unique need or one not yet incorpo-

rated. An organization in New Zealand is developing a model to optimize how sheep and cattle can be moved from the farm to the slaughterhouse to optimize various conditions. Depending upon the user's viewpoint of the model, the factors to optimize might be profit, optimal use of the slaughterhouse, minimum energy costs, or even how to safely circumvent quarantined areas.

In this particular example, the New Zealand road network and its characteristics were available as a vector object for direct use in the **TNTmips** routing processes and for custom modeling in their **SML** processes. This network vector object also has attribute tables containing the characteristics of the road segments. These can be used to provide impedances for the route modeling. A second vector object contains points representing every market destination (the slaughterhouses). A third vector object contains point elements providing the geographic location of every possible farm that would produce input to the model (the animals for sale and transport).

One small problem occurred that was not directly addressed by the **TNTmips** routing process. The farm point locations represented isolated positions not actually on the road network. In other words, the starting point elements were not on the line network. Connecting the farm to the nearest road required that additional functions be added to **SML**. After these functions were added, a script was created [network.sml] to measure the distance from each farm to each slaughterhouse and record this distance in a record attached to the farm point. Multiple distance records are created, 1 for each destination. These additional distance impedances permitted the client to continue on with their special route and farm to market optimization activities.

In this example [network.sml], there were only a few slaughterhouse destinations and many more farm source points. When you review this script, you will find that it traces the route from each destination point back to each source. This is orders of magnitude faster as it traces only a fraction of the possible routes required if the farms were used as starting points, and the shortest distances are identical regardless of the starting points.

A further discussion of this sample script is provided in the attached 2-sided color plate entitled Farm to Market Routing.

Extract Selected Polygons *(included on CD)*.

Often you will find that you are provided with geodata that is arranged in geographical units in many files. Organization and distribution of geodata in these small units may be mandatory for their use in some other limited system or merely optimized for use in that system. Small units may also result due to the commercial or Internet distribution policies of their creator. Small vector objects imported with many layers may be manipulated into more convenient objects using processes in **TNTmips**. However, this time consuming process can be automated using **SML**.

A sample script [tiger.sml] that MicroImages used to create a city layer in the Nebraska Statewide online atlas is provided. A simple city polygon layer was needed for use in queries to isolate street addresses that were often repeated in various Nebraska cities. The TIGER census geodata files contained the city polygons in 93 separate county files along with 100s of other information layers and associated attributes. This sample script in 10 minutes can:

- create a single new statewide destination vector object,
- cycle through the 93 TIGER vector objects,

- extract the city boundary polygons,
- write out the city polygons into the new vector object,
- attach the needed attributes,
- delete redundant boundaries (cities split by a county boundary), and
- delete islands.

A further discussion of this sample script is provided in the attached 2-sided color plate entitled Extract Selected Polygons.

Creating Cumulative Data *(included on CD)*.

The attached color plate entitled Vector Points on Stalks illustrates a new feature added to the **TNT** products to raise pinmaps like flowers on stalks from a 3D surface (like a stacked histogram). As discussed earlier, pins can convey information about the variables creating them (fields in a database record). Now their stalks or roots can also be used to convey tabular data such as the cumulative ethnic makeup of the population represented by the stalk's total height, the thickness of each geologic stratum in a core, or the geochemical concentration of each element assayed.

The first implementation of creating a stalk for a pin required that a separate record be available for each segment of the stalk. Since stalk height is cumulative, each new segment must start out from the end of the previous segment. This requires that the table used has a series of special records for the point where each record defined the next segment to be drawn, thus providing for separate style assignments and the value represented.

It is likely that the data you wish to use to control the stalk height and segments is all in a single record. You can use and modify the simple **SML** script [cumul.sml] to convert it to the required cumulative series of records for immediate use in **V6.50**. Modifications to plot stalks from multiple fields in a single record will be added to the **TNT** products after the release of **V6.50**. However, you will be limited with this kind of input to using only solid line colors for the stalk since 1 record can only have 1 style assignment for lines, thus the multiple record requirement noted above and created by this script.

A further discussion of this sample script is provided in the attached 2-sided color plate entitled Creating Cumulative Data.

Printing Fixed Colors *(included on CD)*.

This **SML** script [compar.sml] provides a model illustrating how a keyboard entry method can be established to automate an activity. In this case, a MicroImages client desired to use printed colors to group, label, and identify results. In their application, other processing in TNTmips produces a series of raster objects that needed to be color coded and printed in a consistent fashion. Unsupervised classification is one example of this activity that might be carried on using different multispectral images whose printed results need to be consistent in color coding. An experienced analyst needs a means of grouping classified values into a color and ensuring that the color will be reproduced accurately from print to print.

The components of this script will guide you in the creation of similar applications where you wish to interact from the keyboard with your custom application. It illustrates how to set up for user input and then parse this input to control the script's functions. Examples for color map creation, manipulation, and saving occur in this script.

A further discussion of this sample script is provided in the attached 2-sided color plate entitled Printing Fixed Colors.

New Functions.

The 42 new functions and 2 new classes outlined below have been added to both **SML/X** and **SML/W**. These include a complete new set of 30 functions/class methods added to use **SML** to create MPEG or AVI movies.

*System functions. (1)

RunAssociatedApplication
Runs application associated with passed file.

Database functions. (3)

TableExists
Returns 1 if table exists, -1 if table doesn't exist.

TableReadAttachment
Returns records that are attached to an element in an object.

TableWriteAttachment
Attaches records to an element in an object.

Raster functions. (1)

PrincipleComponentsExt
Compute principle components and statistics.
[adds new features to older principle component function, see description]

Popup Dialog functions. (1)

PopupSelectTableField
Popup dialog for user to select a table and a field.

File functions. (1)

CreateTempFileName
Create temporary file name.

Widget functions. (1)

CreateUnitOptionMenu
Create an option menu for selecting units.

Vector Network functions. (3)

NetworkCalculateMultiRoute
Calculate a multiroute from source node to destination nodes.

NetworkMultiRouteClose
Close an open network multiroute handle.

NetworkMultiRouteGetRoute
Calculate a route from multiroute to destination node.

Movie Frame functions. (8)

FrameCopy (srcFrame, dstFrame, srcX, srcY, srcW, srcH, dstS, dstY)
Copies a source frame to a destination frame.

FrameCopyFromView (frame, view, srcX, scrY, srcW, srcH, dstX, dstY)
Copies an image from view to frame.

FrameCreate (width, height)
Create frame by width and height (returns handle).

FrameCreateFromView (view)
Create frame from view (returns handle).

FrameCreateGC (frame)
Create a Graphics Context (GC) for a Frame class.

FrameDestroy (frame)
Destroy an open frame handle.

FrameGetHeight (frame)
Get frame height.

FrameGetWidth (frame)
Get frame width.

Movie Creation functions (10).

MovieAddFrame (movie, frame)
Add frame to movie.

MovieExit (movie)
Finalize movie handle.

MovieGetFileExt (movie)
Get file extension.

MovieInit ()
Initialize movie handle (returns handle).

MovieSetFormat (movie, format$)
Set movie format (MPEG or AVI).

MovieSetFrameHeight (movie, height)
Set movie frame height.

MovieSetFrameRate (movie, framerate$)
Set movie frame rate.

MovieSetFrameWidth (movie, width)
Set movie frame width.

MovieStart (movie, filename$)
Start movie recording.

MovieStop (movie)
Stop movie recording.

Define Viewpoint Methods in Class VIEWPOINT3D (12)

SetViewerPosition (viewerpos)
Set viewer position in map coordinates.

SetCenter (center)
Set center of view in map coordinates.

SetDistance (distance, unittype$, recalculate$)
Set distance between center of view and viewer position in specified units.

SetAzimuthAngle (angle, recalculate$)

Set azimuth angle of view direction in degrees.

SetRollAngle (angle, recalculate$)
Set roll angle of view direction in degrees.

SetElevationAngle (angle, recalculate$)
Set elevation angle of view direction in degrees.

SetSunAzimuthAngle (angle)
Set azimuth angle of sun direction in degrees.

SetSunElevationAngle (angle)
Set elevation angle of sun direction in degrees.

MoveCenter (azimangle, elevangle, distance, unittype$)
Move from current to new center specified by azimuth angle, elevation angle, distance, and units.

RotateCenter (angle)
Rotate center around viewer position in degrees.

MoveViewerPosition (azimangle, elevangle, distance, unittype$)
Move from current to new viewer position specified by azimuth angle, elevation angle, distance, and units.

RotateViewerPosition (angle)
Rotate viewer position around center viewpoint in degrees.

Geodata Display View (1) *this function is not on the CD and must be downloaded.*

ViewRedrawDirect
Blanks View window before each redraw to supress flashing between frames.

New Classes.

MultiRoute
MultiRoute handle used with network functions.

PRINCOMPSTATS
Calculate principle components for a raster set.
Members
NumBands: number
Determinant: number
Total Variance: number
GetEigenVector:
GetEigenValues:
GetCorrelation:
GetCovariance:
GetMean:
GetTransVector:

Upgrading.

If you did not order **V6.50** of **TNTmips** in advance and wish to do so now, please contact MicroImages by FAX, phone, or email to arrange to purchase this version. When you have completed your purchase you will be provided with an authorization code. Entering this authorization code while running the installation process lets you to complete the installation of **TNTmips 6.5**.

The prices for upgrades from earlier versions of **TNTmips** are outlined below. Please remember that new features have been added to **TNTmips** with each new release. Thus, the older your current version of **TNTmips** relative to **V6.50,** the higher your upgrade cost will be.

Within the NAFTA point-of-use area (Canada, U.S., and Mexico) and with shipping by UPS ground. +150/each means US$150 for each additional upgrade increment.

TNTmips Product	Price to upgrade from **TNTmips**:					**V5.90**
	V6.40	**V6.30**	**V6.20**	**V6.10**	**V6.00**	and earlier
Windows/Mac/LINUX	$500	750	950	1100	1250	+150/each
for floating license	$600	900	1140	1320	1500	+150/each
DEC/Alpha via NT	$650	1000	1350	1600	1800	+175/each
UNIX single user	$800	1250	1650	2000	2250	+200/each
for floating license	$960	1500	1980	2220	2640	+220/each

For a point-of-use in all other nations with shipping by air express. +150/each means US$150 for each additional upgrade increment.

TNTmips Product	Price to upgrade from **TNTmips**:					**V5.90**
	V6.40	**V6.30**	**V6.20**	**V6.10**	**V6.00**	and earlier
Windows/Mac/LINUX	$600	900	1150	1400	1600	+150/each
for floating licenses	$720	1080	1380	1680	1920	+150/each
DEC/Alpha via NT	$750	1200	1550	1800	2000	+175/each
UNIX single user	$900	1400	1850	2200	2500	+200/each
for floating licenses	$1080	1680	2220	2640	3000	+200/each

Installed Sizes.

Loading **TNTmips 6.5** processes onto your hard drive (exclusive of any other products, data sets, illustrations, and so on) requires the following storage space in megabytes.

	for **V6.40**	for **V6.50**
PC using W95, W98, WME, NT, or W2000	83 Mb	80 Mb
PC using LINUX (with Intel) kernel 2.0.36 to 2.4	111 Mb	107 Mb
Mac using Mac OS 8.x or 9.x	97 Mb	84 Mb
SGI workstation via IRIX	145 Mb	141 Mb
Sun workstation via Solaris 2.x	120 Mb	116 Mb
IBM workstation via AIX 4.x (with PPC)	169 Mb	164 Mb
COMPAQ/DEC workstation via Tru64 UNIX (with Alpha)	176 Mb	169 Mb

V6.50 of the HTML version of the Reference Manual, including illustrations, requires 42 Mb. Installing all the sample geodata sets for **TNTlite** and **TNTmips** requires 185 Mb. The 58 Getting Started booklets require a total of 124 Mb.

Computers

Computer manufacturers and prices are in such a state of flux that any recommendations here would be immediately outdated. Due to the price wars, it is a good time to buy that new machine if you are several years behind in your model. If you are current on your desktop and not buying a new machine at this time, it is still a good time to add memory. Commonly used PC100 and PC133 SIMMs of 128 Mb can be obtained on sale at US$40 but prices are now expected to increase as supplies are reduced. The

new Virtual Desktop or large X workspace will make good use of additional memory added to an existing or new system. Cheap, abundant memory provides the opportunity for improvements in future **TNT** product releases—most immediately in improvements in your use of a large workspace and in **TNTsim**.

Large Format Color Scanner.

One of MicroImages dealers has reported good success with a new line of large format map scanners. These scanners use a fiber optics array that stretches entirely across the area to be scanned. All pixels in a line are read in this fashion so that scans are very fast. For further information see www.widecom.com/products.htm.

Hard Drives.

The hard drive price wars seem to have ended with the purchase of Quantum by Maxtor. Maxtor 80 gigabyte drives still seem to be tops for the low budget system. The price of this drive is now as low as US$240 if you shop around. Occasional special sales on 60 Gb drives are now putting it at US$150. It is unlikely that many new larger/cheaper drive options will emerge before the Christmas season.

Internationalization and Localization

The **TNT** products can be used in the official national languages of 3 billion of the Earth's 4.5 billion population. Thus 2/3 of the population is supported. No new languages were added since **V6.40** was released. Instead, effort was concentrated upon improving the use of those already supported, particularly those without reliable BDF fonts.

TrueType Fonts for X Server.

You are already using TrueType fonts in your language within your **TNT** processes. Now you can use these same or other TT fonts in the X server for your interface components. Selecting from TT fonts will greatly improve your selection of fonts, styles, and sizes. TT eliminates the need for the larger, ungainly BDF and outline fonts. TT improves the accuracy and appearance of the rendering of many languages by supporting more special characters and special forms. An expanded discussion of the support of TT can be found above in the section on the X server that describes its many other enhancements.

Spatial Manipulation Language.

You may wish to prepare **SML** scripts that operate in another language. Adjustments have been made so that **SML** is fully internationalized. Now you can create a specialized product to solve a specific, local geospatial application for direct use by those who speak only 1 national language. It is unlikely that any other robust geospatial programming language provides this ability to reach a local population with easily understood applications.

Input and output strings such as error messages originating within **SML** functions can be translated via the **TNT** language resource files. The text you generate within the script for use in your windows, dialogs, and so on must be included directly in the script in the chosen language. The color plate attached entitled Localizing SML Scripts provides guidelines on preparing a script in another language or translating one that already exists.

Note! If your language is missing, please contact MicroImages for information on plans to add it or to discuss becoming its official translator.

MicroImages Authorized Dealers

4 new dealers located in The Philippines, Colombia, Argentina, and Panama were added during the past semester. MicroImages' product sales are principally made through our excellent dealers or by referrals from our current valued client base. As a result, new dealers are being aggressively sought, especially in nations without any. Additional dealers are also sought in larger nations where our current dealer(s) have specialized in one particular application area of geospatial analysis. Any MicroImages client or anyone else interested in becoming a dealer, please contact Terry Peterson (peterson@microimages.com). Inquiries are welcome from anyone, big or small.

For a complete list of all the current MicroImages Authorized Dealers please check microimages.com/dealers for an updated address, email, phone, FAX, services, and web site information.

Manila – RPM-iT

MicroImages is pleased to present Resource Planners, Managers and Information Traders (RPM-iT) as a new dealer in the Philippines. RPM-iT was organized in 2000 by several experienced professionals to provide geospatial services to agricultural, business, government, and educational clients. The initial core staff of RPM-iT is experienced in Philippine government and university procedures, international agricultural consulting, graphics design, and related applications. RPM-iT has already prepared and provided the translation (resource) files to permit the local operation of the **TNT** products in Tagalog, the official language of the Philippines. For further information contact Dr. Roger C. Lazaro at voice (632)823-2308 or FAX (632)823-2308 or email at rclazaro@philonline.com or mail at 30 Bolivia St. BLS, Bicutan, Paranaque 1711, Metro-Manila, Philippines. (web www.philonline.com.ph/~rclazaro)

Bogota – Infographics S.A.

MicroImages is pleased to present Infographics, Analisis de Informacion Georreferenciada, as a new dealer in Colombia. Infographics was incorporated in 2000 as the 4th in a partnership by 3 other supporting firms with offices throughout Colombia dealing with computer vision, database systems, and marketing. The several professional staff making up this company have extensive previous experience in prior positions in the marketing, installation, and use of ESRI and MapInfo products. They have also been the principal staff involved in the development of several geodatabases for Colombia. The **TNT** products will be this firm's principle software offerings for geospatial analysis in Colombia and other Spanish speaking nations. For further information contact Reynaldo Jose Bernal at voice (571)618-4348 or FAX (571)618-4209 or email at admin@infographics.com.co or mail at Calle 101, Carrera 29-40, Bogota, Colombia. (web www.infographics.com.co or www.geomarketing.com.co)

Panama City – MapIntec Geotechnologies Inc.

MicroImages is pleased to present MapIntec Geotechnologies as a new dealer in Panama. MapIntec is a consulting firm providing remote sensing, GIS, GPS, mineral ex-

ploration, core drilling, and environmental services to private business in Panama. MapIntec has previous experience in marketing, installing, and supporting ESRI, Zycor, and Landmark Graphics software and in the application of AutoCAD and MapInfo software. For further information contact Zorel J. Morales at voice (507)228-9384 or FAX (507)228-9385 or email at zjmcypan@pty.com or mail at MapIntec Geotechnologies, P.O. Box 9464, Zona 9, Panama City, Panama.

Cordoba – PROCON

MicroImages is pleased to present PROCON as a new dealer in Argentina. PROCON is a consulting engineering company organized in 1992 specializing in the preparation of geospatial data and custom software. They are authorized dealers for AutoDesk, 3D StudioMax, and related products. For further information contact Ruben Actis Danna at voice (5435)4348-8630 or FAX (5435)1422-3495 or email at ractisdanna@agora.com.ar or mail at Avenida San Marin 2337, Uniquillo, Cordoba 5109, Argentina.

Discontinued Dealers

The following dealers are no longer authorized to sell MicroImages' products. Please do not contact them regarding support, service, or information. Please contact MicroImages directly or one of the other MicroImages Authorized Dealers.

Focus Integrated Systems S.A.E. (Tamer Fahmy) of Cairo, Egypt is discontinued.

HyperInfo International Inc.(HII). (Qingxi Tong) of Beijing, China is discontinued.

HyperInfo International Inc.(HII). (Jinnian Yang) of Toronto, Canada is discontinued.

Papers on Applications

Comparison of Three Water Erosion Prediction Methods (137Cs, WEPP, USLE) in South-East Brazilian Sugarcane Production. G. Sparovek, O.O.S. Bacchi, E. Schnug, S.B.L. Ranieri, and L.C. De Maria. Journal of Agriculture in the Tropics and Subtropics. Vol. 101, October 2000. pages 107-118.

Combination of Digital Aerial Photography and Satellite Remote Sensing to Assist Contemporary Restructuring in an Urban Area of South Africa. Hannes Botha and Ronnie Donaldson. Using Geocarto International, Vol. 15, No. 3, Sept. 2000. pages 53-62

Abstract. The transition and restructuring process of urban South Africa are currently in the phase of identifying land development objectives. These objectives aim to integrate previously segregated areas through integrated development plans. This research aims firstly to identify and describe the historical development of the spatial form and structure of the secondary city and capital of the Northern Province, Pietersburg and its dispersed peripheral towns. Supervised classification of SPOT HRV multispectral imagery is used to support the theoretical explanation. Images from airborne digital Kodak DCS 420 camera are used to provide training sites in the pre-classification stages, and also provide field data to the process of post-classification accuracy assessment. Secondly, SPOT HRV imagery is applied to identify the stark contrast in urban development between the city of Pietersburg and its surrounding former homeland towns. Both built and natural environmental aspects are investigated. In conclusion, benefits and problems of assessing urban morphology and development in a developing county by means of a combination of satellite imagery and digital aerial photography are discussed.

Reviews

User Needs Drive Web Mapping Product Selection. W. Frederick Limp. February 2001. GEOWorld, Vol. 14, No. 2. pages 8 to 22.
[see article at www.geoplace.com/gw/2001/0201/0201wm.asp]

In late 1999, GEOWorld took a snapshot of Web mapping software (see "Mapping Hits Warp Speed on the World Wide Web" and "Don't Hit Warp Speed with the Wrong Equipment." GEOWorld September and November 1999, pages 32 and 44, respectively). In 2000, the pace of innovation increased thanks to several major new developments affecting Web mapping. … Here I revisit basic Web mapping requirements: What capabilities do users need, how can they accomplish their goals, and what are the trade-offs? A lot has changed since 1999. There are more vendors, more products and more capabilities. To help sort through the options, the GEOWorld staff and I have prepared a series of tables to summarize today's Web mapping products. There are three charts: The first provides details on system characteristics, the second examines the spatial data formats that can be used, and the third covers the functions provided by the various products. …

Millennium Moves: Raster GIS and Image Processing Products Expand Functionality in 2001. W. Frederick Limp. April 2001. GEOWorld, Vol. 14, No. 4. pages 38 to 42. [see full article at www.geoplace.com/gw/2001/0401/0401move.asp]

Abstract: Raster GISs excel in the complex analysis of geospatial data. Although there are areas in which vector-based analysis is superior, most complex analyses require raster systems.

The many users of ESRI products will disagree strongly with this abstract and premise of this paper. It is also unfortunate that this paper continues to perpetuate the United States' orientation toward continued separation of GIS (in this case vector GIS) from Image Processing into this century. The author acknowledges that remote sensing and image processing are coming together, but clearly does not use the word geospatial in the fashion in which it is used everywhere else in the world. The paper also ignores the fact that all serious vendors are working hard to eliminate boundaries between raster and vector geodata structures or to form cooperative products that do so.

Appendix: Abbreviations

For simplicity, the following abbreviations were used in this MEMO:

W95 = Microsoft Windows 95.

W98 = Microsoft Windows 98.

WME = Windows Millennium Edition.

NT or NT4 = Microsoft NT 4.0 (3.1 and 3.5 are error prone, and thus the **TNT** products require the use of NT4.0 and its subsequent Service Packs). NT4 now has a Service Pack 6a available. Windows 2000 now has Service Pack 1 available, but it is not recommended unless you are having problems with your installation.

W2000 = Microsoft Windows 2000.

Mac = Apple Macintosh using the PowerPC G3 or G4 processors and Mac OS 9.x. This abbreviation Mac does not refer to Mac OS 10.x in any way unless explicitly noted.

MI/X = MicroImages' X server for Mac and PC microcomputer platforms and operating systems.

GRE = MicroImages' Geospatial Rendering Engine, which is at the heart of most MicroImages products. The current **GRE** will respond and render for requests from either X/Motif or Windows.